

GIS and Geologic Mapping

The background of the slide features two globes. The globe on the left is a map of Mars, showing various geological features and craters in shades of green, yellow, and brown. The globe on the right is a map of Venus, showing a more complex geological landscape with prominent features in red, orange, and brown. Both globes are overlaid with a grid of latitude and longitude lines.

*Tools and methods to get started using
GIS geologic mapping*

USGS Astrogeology

Introduction

■ Goals

- Orient planetary mappers to GIS and vector editing
- Define geodatabase template - “what mappers get”
- Ultimately, assist in map submission, review, and production

■ Format

8:30 - 12:00	Review of previous modules (with breaks, discussions, demos, as necessary)
12:00 - 1:00	Lunch
1:00 - 1:30	Crater/Feature tool
1:30 - 2:30	Crater counts
2:45 - 3:45	Annotation / Map finalization
3:45 - 5:00	New ArcMap 10 features

Format of Morning Presentation

- General Comments
- GIS Package
 - Rationale, USGS Role, Example

Notes

- This is a recap of past presentations
 - *We rely on mapper's feedback to dictate content of modules. Please let us know what you want to see in future workshops.*
- Though this presentation is geared toward planetary mapping, the information is relevant to all GIS users
- Screen-shots likely to differ from individual views
- GIS skills are developed through trial and error

GIS Support

- Planet-specific information (e.g., data, discussion, tutorials)
 - *<http://webgis.wr.usgs.gov/>*
- USGS discussion board (login required)
 - *<http://isis.astrogeology.usgs.gov/> ... navigate to “Support” → “Planetary GIS Discussions”*
- Contact USGS Astrogeology



“Plugging keywords into a internet search engine is a great way to search for GIS-related assistance!”

GIS Support (cont'd)

- ESRI online portal to technical information
 - *<http://support.esri.com>*
- ESRI ArcScripts
 - *<http://arcscripts.esri.com/>*
- ESRI Educational Services
 - Instructor-led training
 - Virtual Campus courses
 - Web workshops
- Self-guided tutorials and manuals

GIS Package

GIS Package

A Standard Template for All Mappers

- PGG 2008 A/O, USGS produce, distribute, and support geologic mapping template
- Base maps (body and scale dependent)
 - Mars: THEMIS daytime IR mosaic (+MOLA DEM)
 - Moon: Lunar Orbiter mosaics and Clementine bands
 - Venus: Magellan mosaics (+gridded data)
- High resolution images
 - Will provide Global GIS DVD for body of interest
 - Footprints can be imported from that DVD
 - “Fieldwork” component of mapping
 - If more than above is required for map objectives (i.e., CTX mosaics), contact Ken Tanaka prior to submission to ensure USGS can provide ... not guaranteed
 - Include Co-I's or Collaborators if georeferenced data is required
 - Provide georeferenced data and we will include in your GIS package

GIS Package

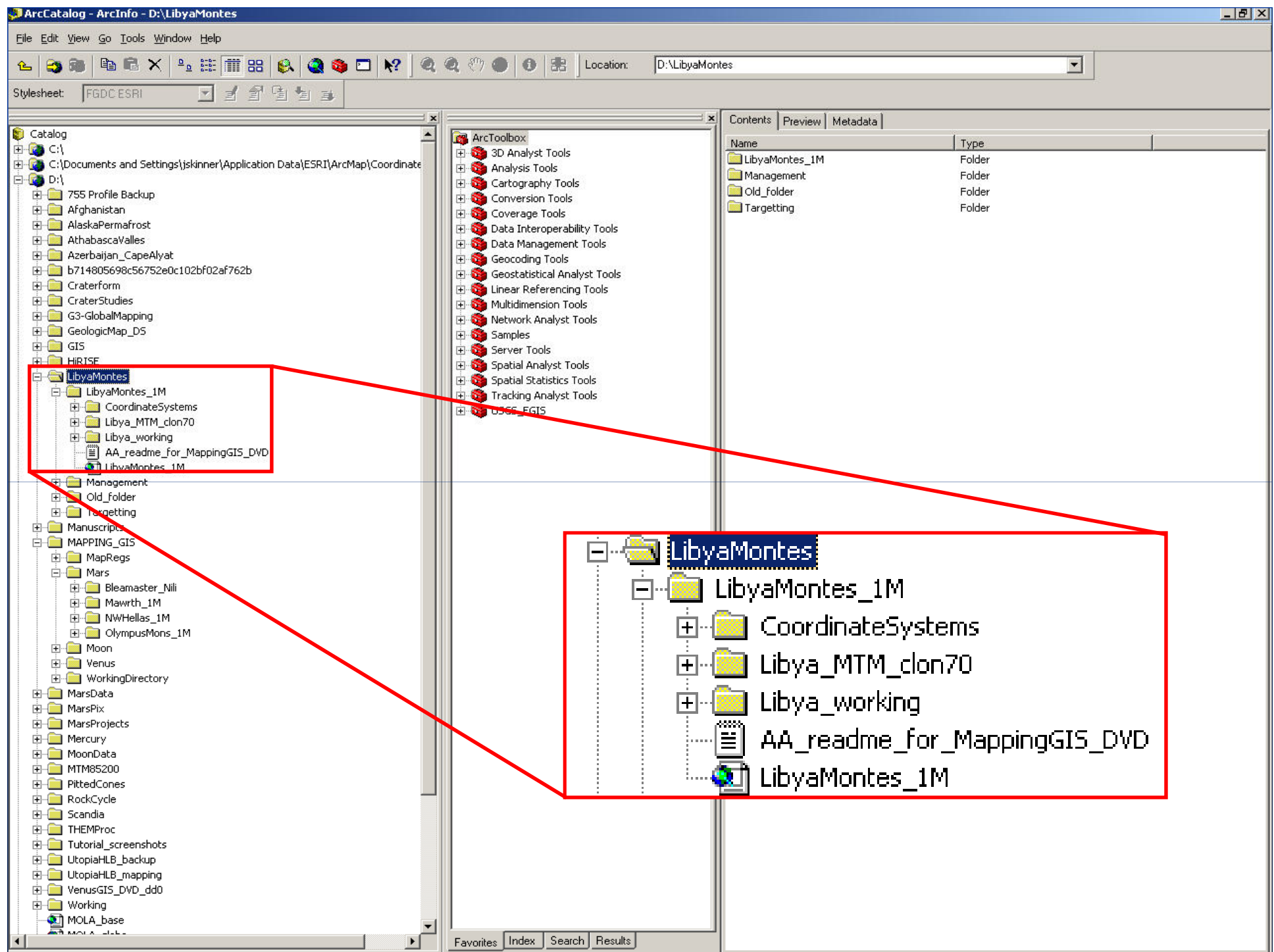
What you can expect from USGS

- All packaged into a “standard GIS mapping package”
 - Base maps
 - GIS geodatabase with projection and vector attributes
 - FGDC-derived feature symbols applied
- Ensures:
 - All mappers start with equivalent product
 - We can support your work through call-in or web posts
 - Template for final submission
 - Mappers know what to expect from USGS for proposals and can plan accordingly

GIS Package

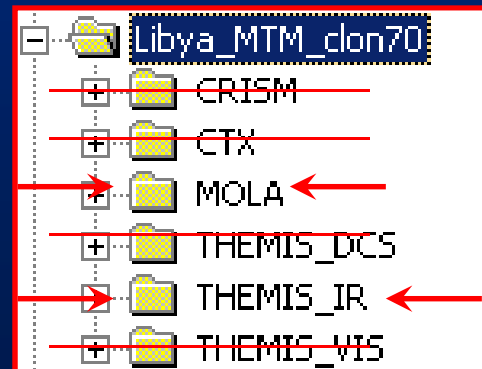
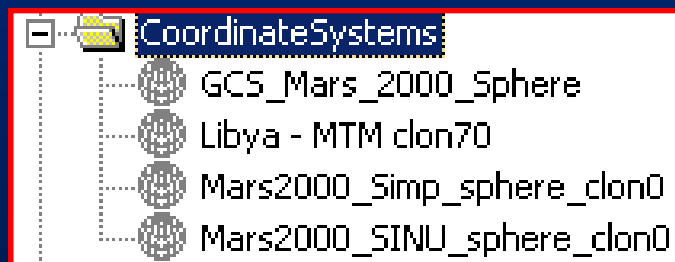
Libya Montes example

- Six quadrangles
- Mars Transverse Mercator (clon of 70E)
- Example includes non-standard products (THEMIS DCS and CRISM summary parameters generated by Co-Investigators)



GIS Package

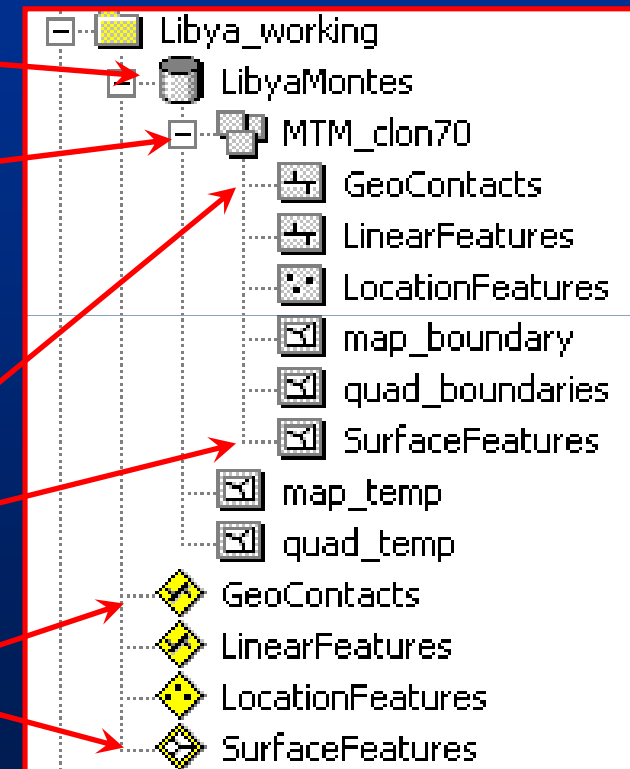
File Organization



GIS Package

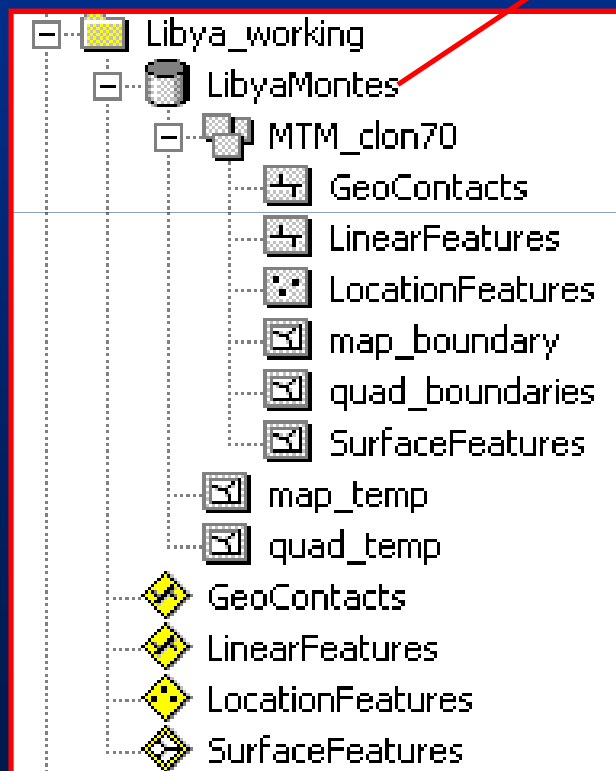
Geodatabase Design

- GDB contains feature attributes as domains
- Feature dataset houses map projection
- Vector layers are pre-built and can be adapted and copied, as needed
- Layer files contain attribute symbols



GIS Package

Geodatabase Domains



Database Properties

General Domains

Domain Name	Description
contact	type of geologic contact
linear feature	type of linear feature
point feature	type of point feature
polygon feature	type of polygon feature

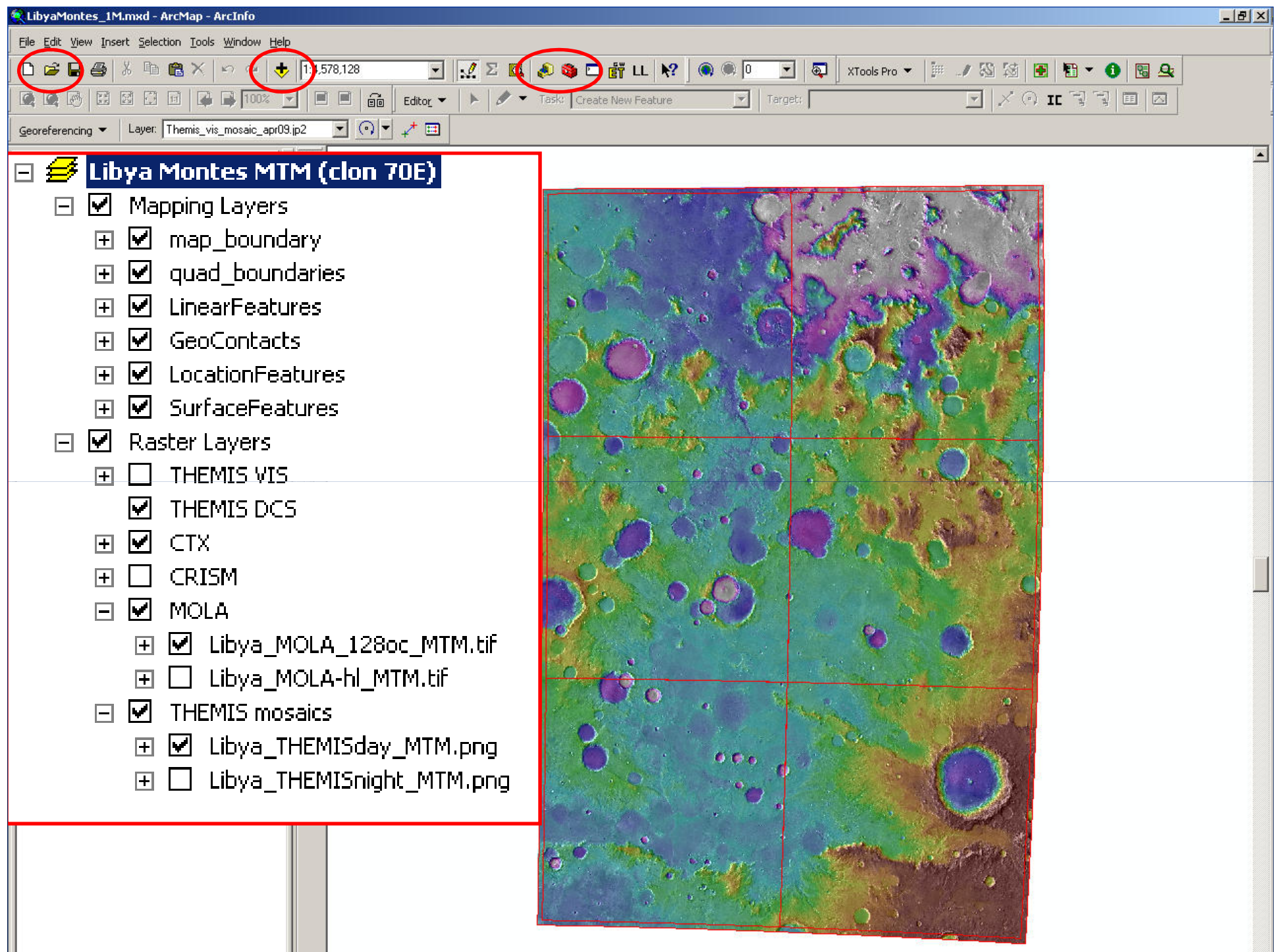
Domain Properties:



























Field Type	Text
Domain Type	Coded Values
Split policy	Default Value
Merge policy	Default Value







Coded Values:




Code	Description
certain	certain
approximate	approximate
inferred	inferred
concealed	concealed
gradational	gradational










OK Cancel Apply



- ☐ ☒ LinearFeatures
 -  <all other values>
 - TYPE
 -  sinuous channel or groove
 -  channel (fluvial)
 -  channel (volcanic)
 -  crest of buried crater
 -  crest of crater rim
 -  depression margin
 -  dome margin
 -  fault, certain
 -  fault, approx.
 -  graben trace, approx.
 -  graben trace, certain
 -  groove
 -  lineament
 -  normal fault, approx.
 -  normal fault, certain
 -  reverse fault, certain
 -  reverse fault, approx.
 -  ridge crest (type 1), certain
 -  ridge crest (type 1), approx.
 -  ridge crest (type 2), certain
 -  ridge crest (type 2), approx.
 -  scarp base
 -  scarp crest
 -  small crater rim
 -  trough

- ☐ ☒ GeoContacts
 -  <all other values>
 - TYPE
 -  certain
 -  approximate
 -  concealed
 -  gradational
 -  inferred

- ☐ ☒ LocationFeatures
 -  <all other values>
 - TYPE
 -  pitted cone
 -  small crater

- ☐ ☒ SurfaceFeatures
 -  <all other values>
 - TYPE
 -  dark-colored ejecta
 -  dark-colored mantling material
 -  patterned ground (type 2)
 -  patterned ground (type 1)
 -  polygonal terrain
 -  residual ice
 -  secondary crater chain
 -  thumbprint terrain

•Symbols can be adapted to fit individual needs

•Will adapt to cartographic standards over time

•Accessed via dropdown menu while digitizing

GIS Package *Support File*



- Standard format and content
- Versioned, with notes on updates
- ISIS map file
- Install instructions
- Link to global datasets

Basic Training

Basic Training

Topics

- Helpful Hints
- ArcCatalog
- Building a geodatabase
- Adding attributes, feature data sets, features, raster data
- Editing features
- Conducting spatial analyses

Basic Training

Helpful Hints

- Keep project data organized
- Periodically delete temporary files to avoid clutter
- Use succinct but conspicuous names for folders and files
 - */UtopiaMapProj/June08Lines/geo_contacts_june08.shp*
- Use dual display, if possible (2 screens)
 - *Assists with toggle between programs*
 - *Great for viewing hotlinked images*
- Keep vector data clean
 - *Snap linework!!! – Avoids excessive cleaning at project end*
 - *Experiment with which tolerances work best for your digitizing scale*
- Keep detailed notes on GIS settings, methods, and approaches
- Use point files to hold temporary/evolving geologic units

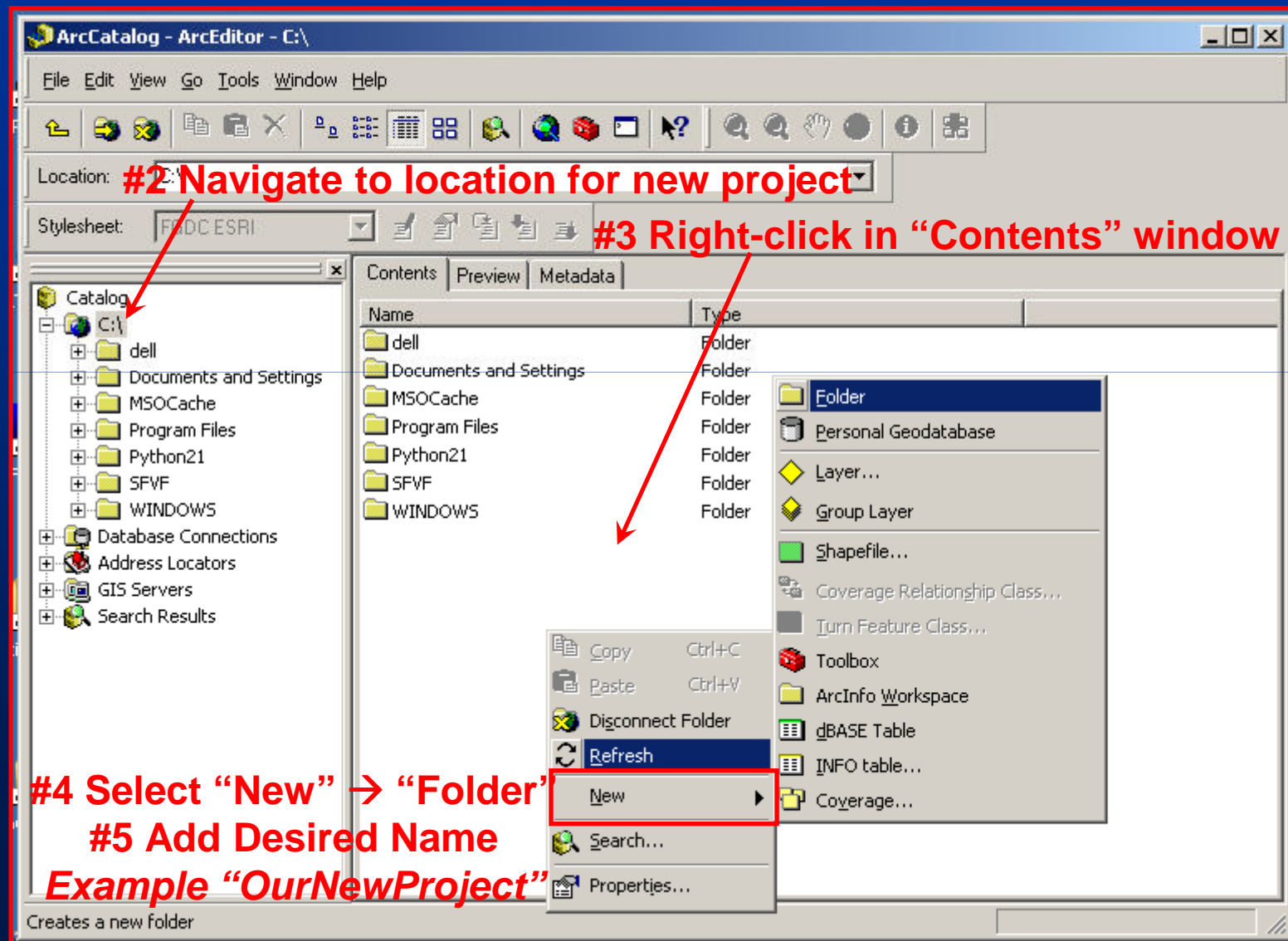
Basic Training

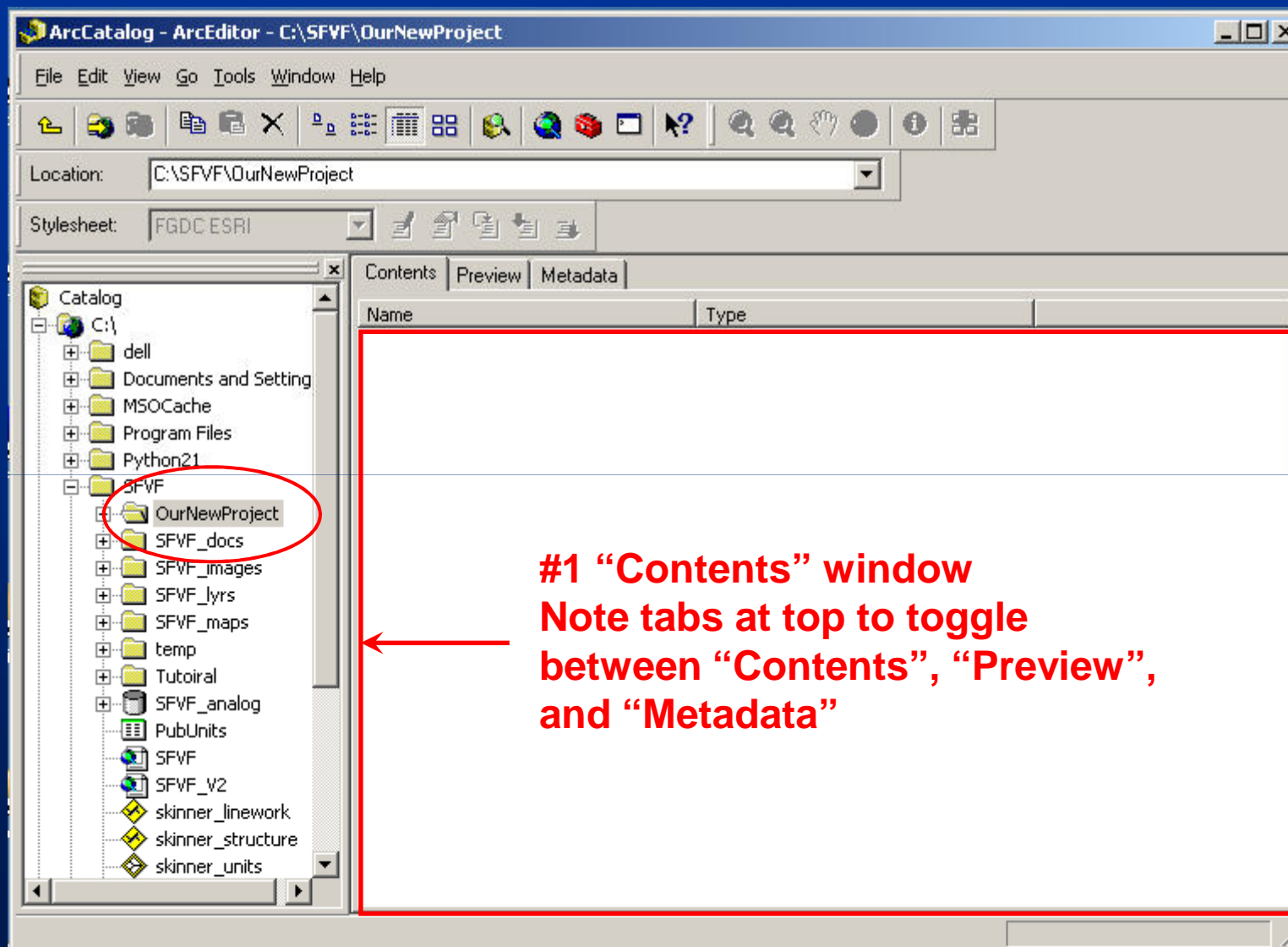
ArcCatalog

- Critical interface for data creation and exploration
- Separate entity from ArcMap
- Interface is similar to Windows Explorer
 - *Create new file*
 - *Add/Delete folders or files*
 - *Good operating environment for ArcToolbox*
 - *Almost always running in background*
 - *ArcMap is opened and closed routinely*

To create a new project folder...

#1 Open ArcCatalog



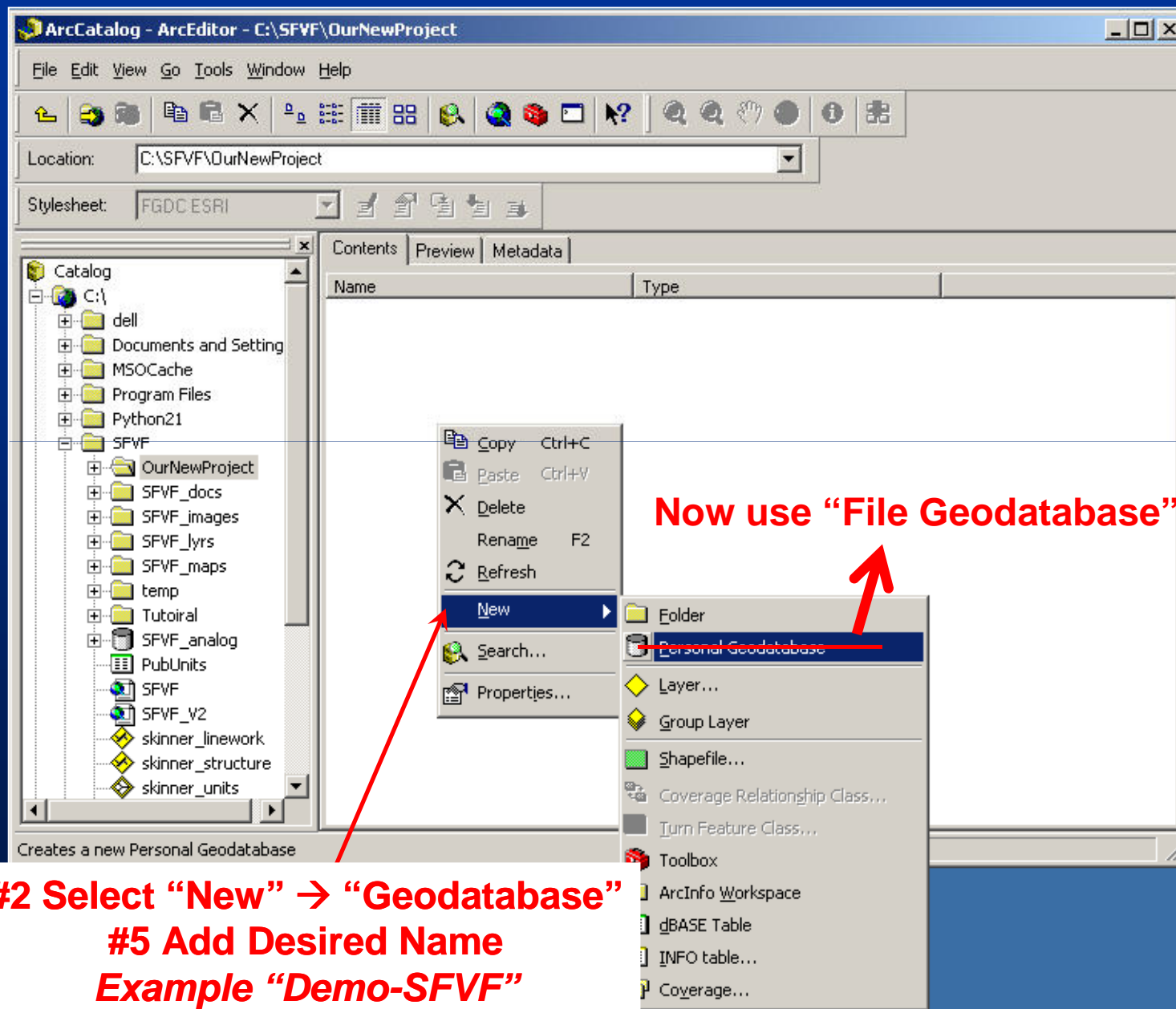


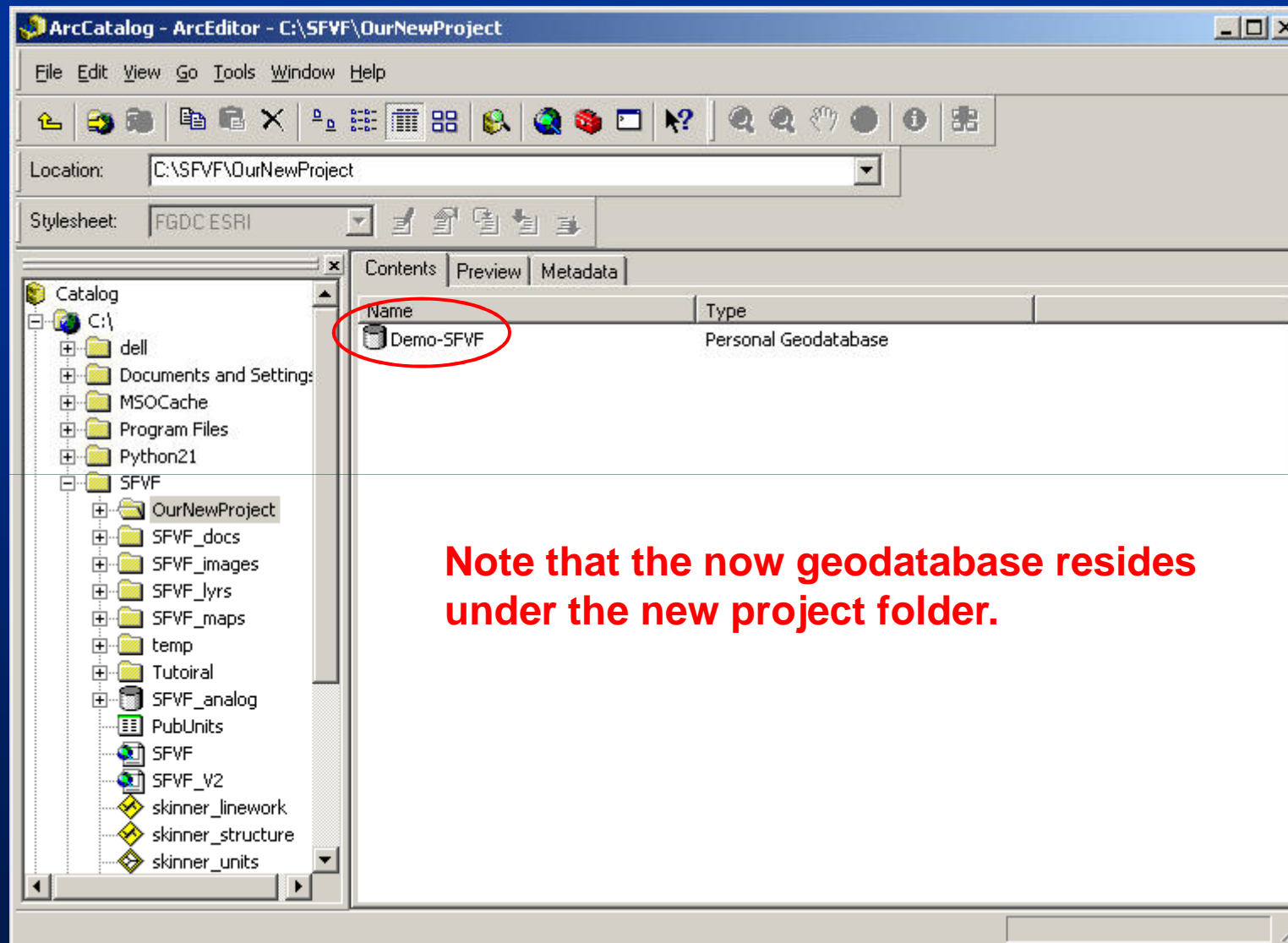
Basic Training

Geodatabases

- ESRI FILE Geodatabase
 - *Holds all project information*
 - *Vector, raster, tables, topology, toolboxes, domains*
 - *Nicely organizes vector layers – e.g., contacts, structure*
- Is not assigned projection information
 - *Projection assigned to sub-level features and collections of features (feature datasets)*
- Transferable to colleagues
- Promotes data organization and management
- Stable

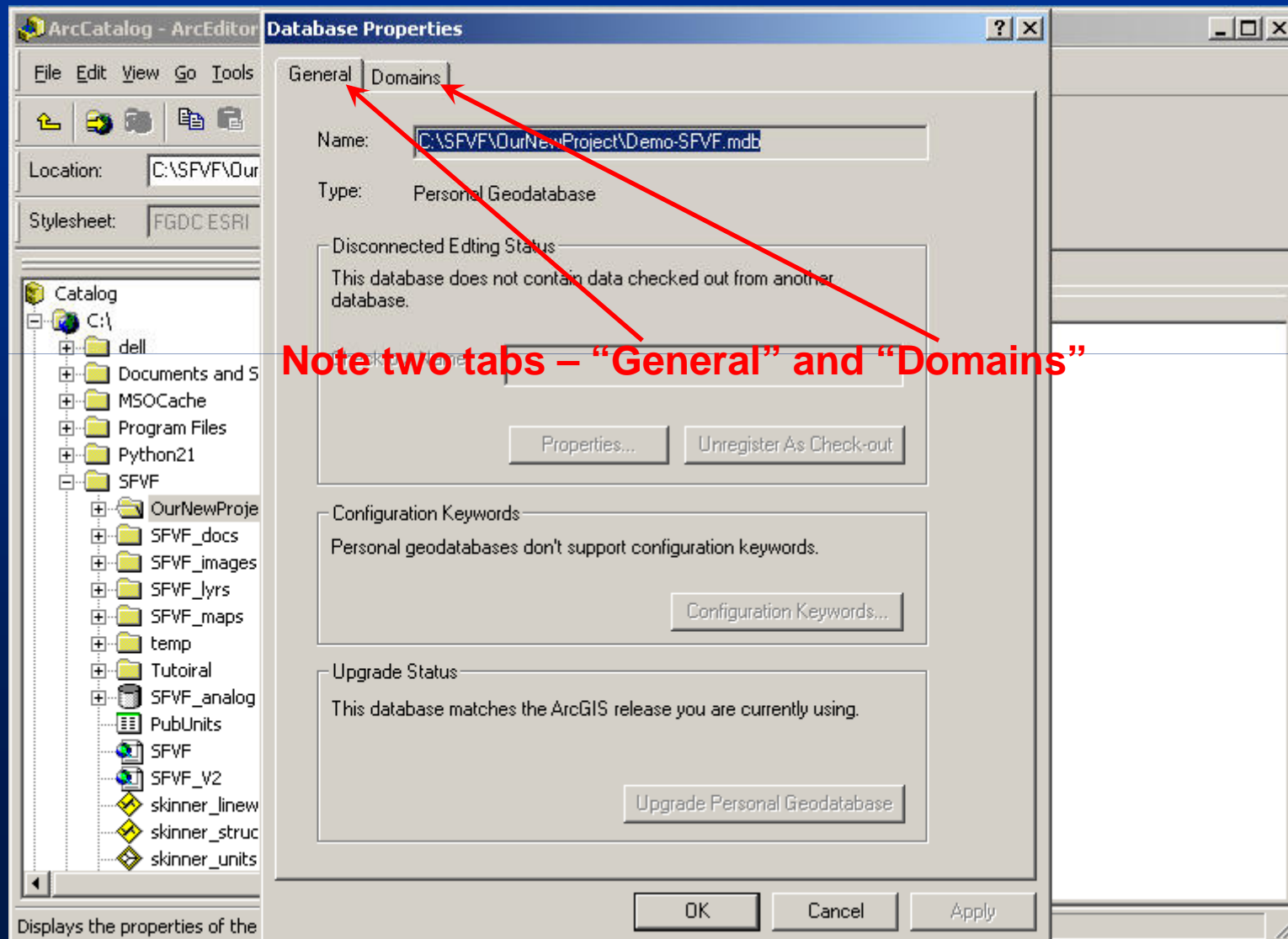
To create a new geodatabase...



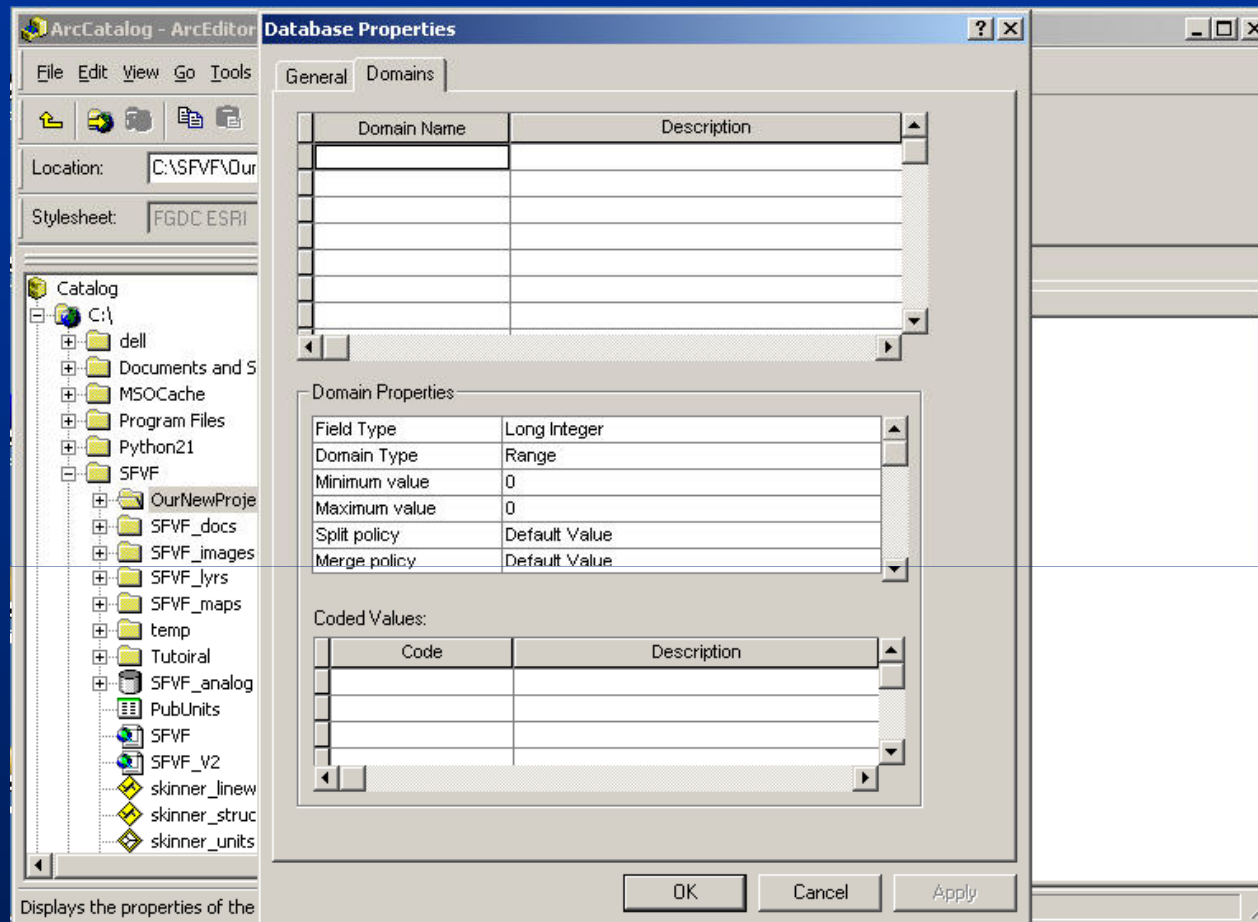


To examine geodatabase props...

#1 Right-click on Demo-SFVF geodatabase and select “Properties”



To examine geodatabase domains...



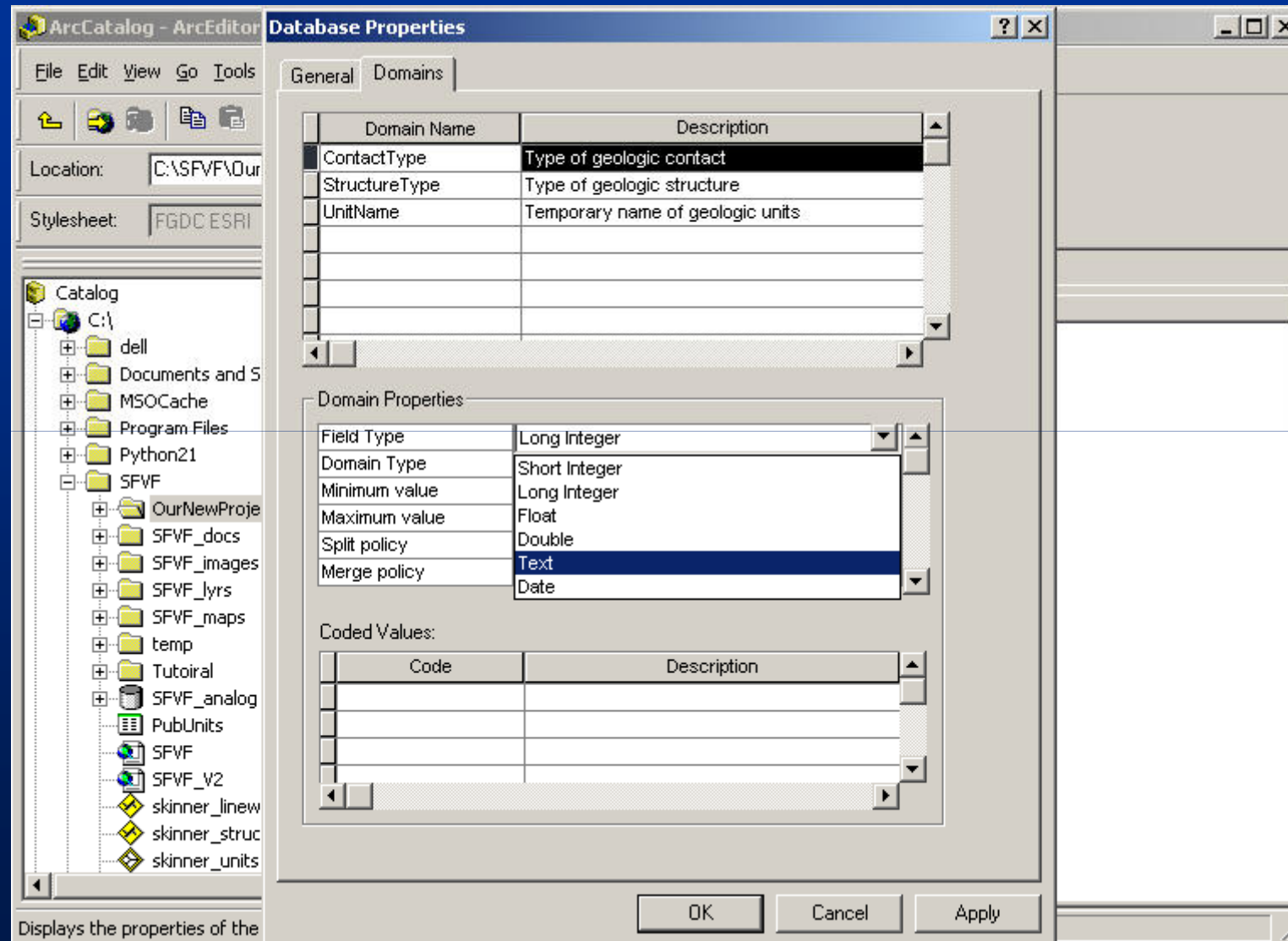
“There is significant difference between “attribute domain” (described above) and “spatial domain”. Use Arc Help for more information on this important difference.

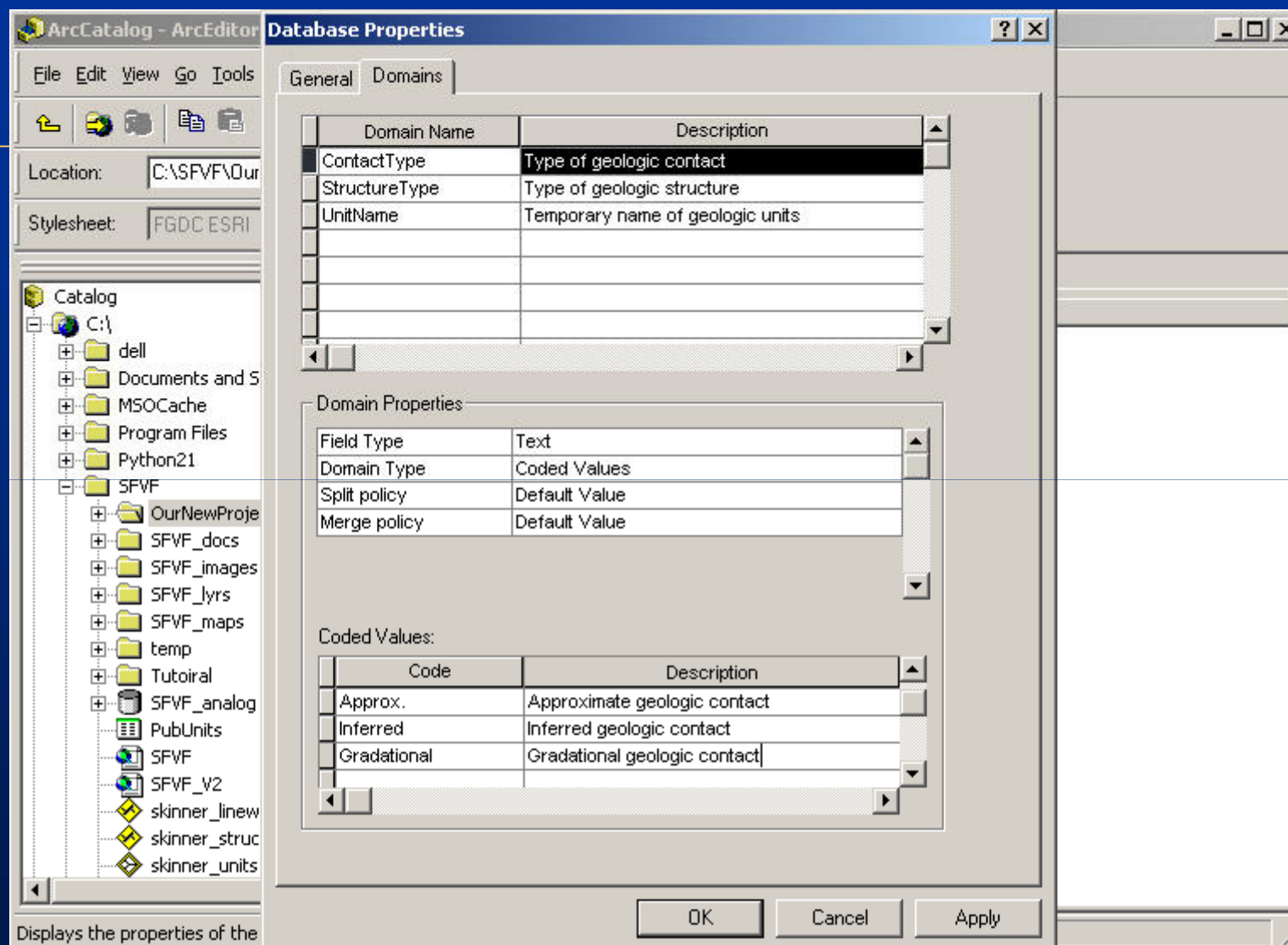
Basic Training

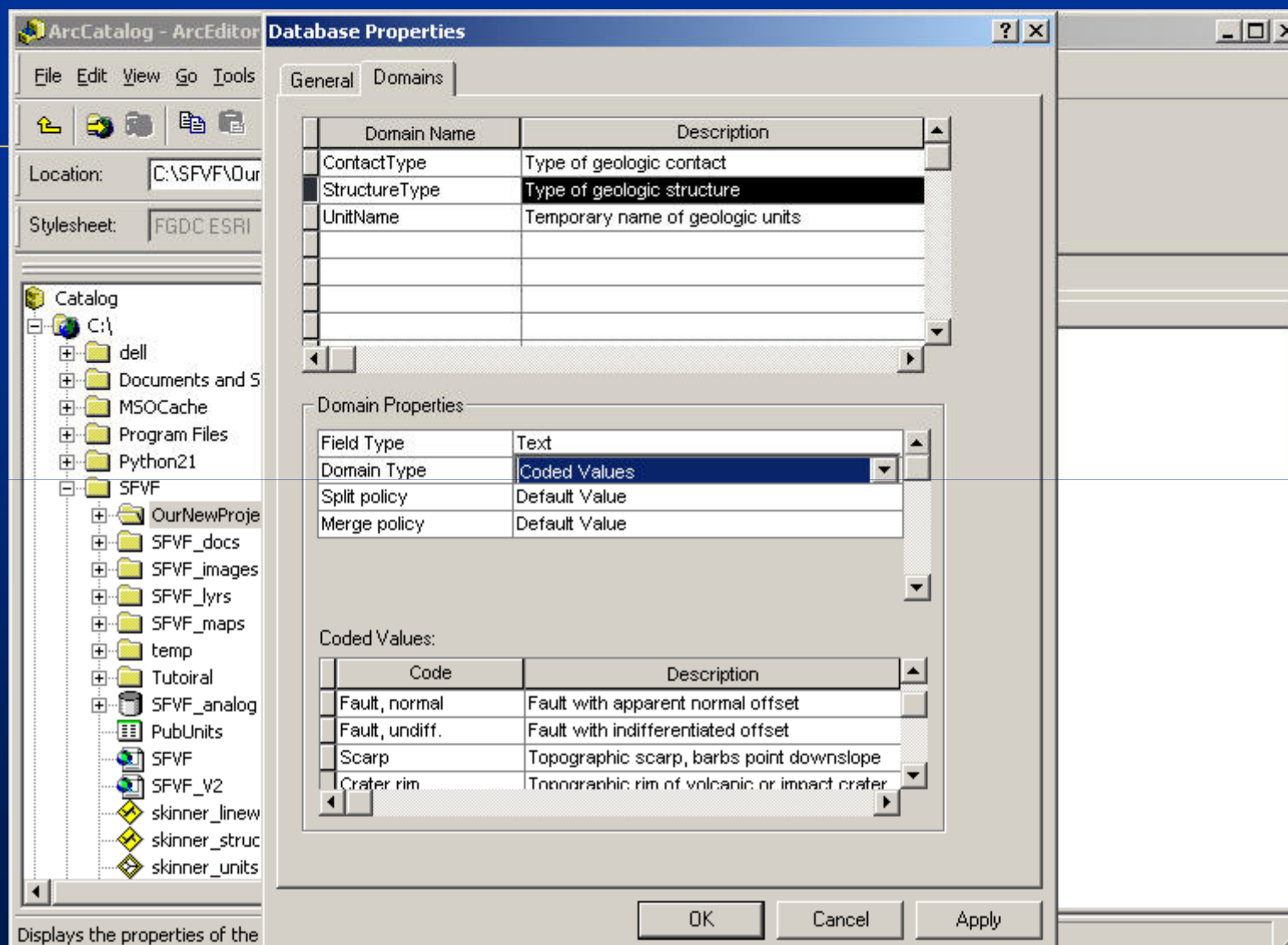
Attribute Domains

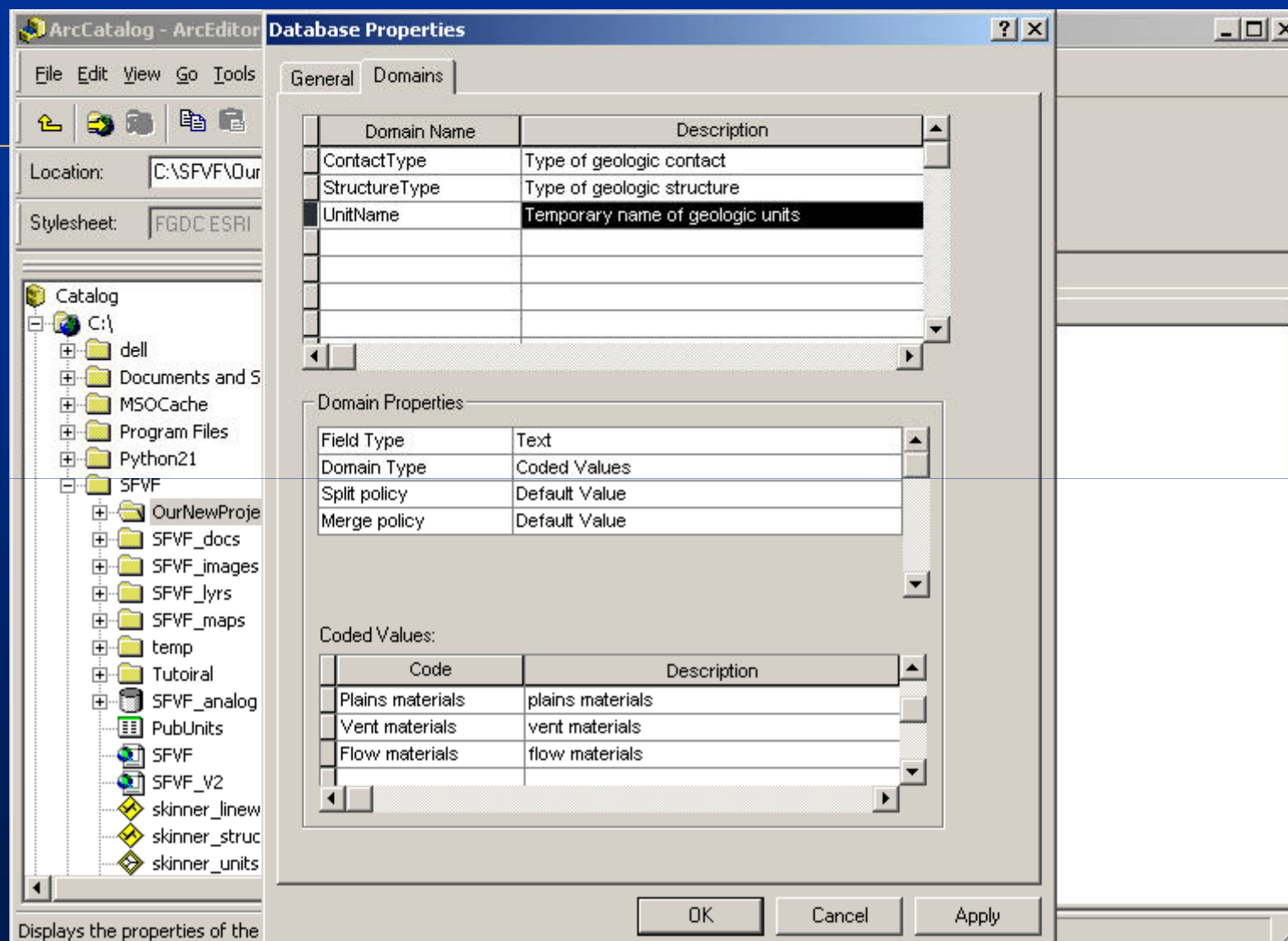
- Property of geodatabase
- Defines a range of values to be use as attribute fields
- Ensure data integrity by limiting the choice of values
 - *User restricted to choices available from dropdown list*
- Useful for features “known” to exist in a particular region
 - *Contact attributes (e.g., certain, approximate, concealed)*
 - *Structure and feature attributes (e.g., ridge, trough, crater rim, flow direction)*
- Can be used for geologic unit attributes, but requires iteration

To change geodatabase domains...





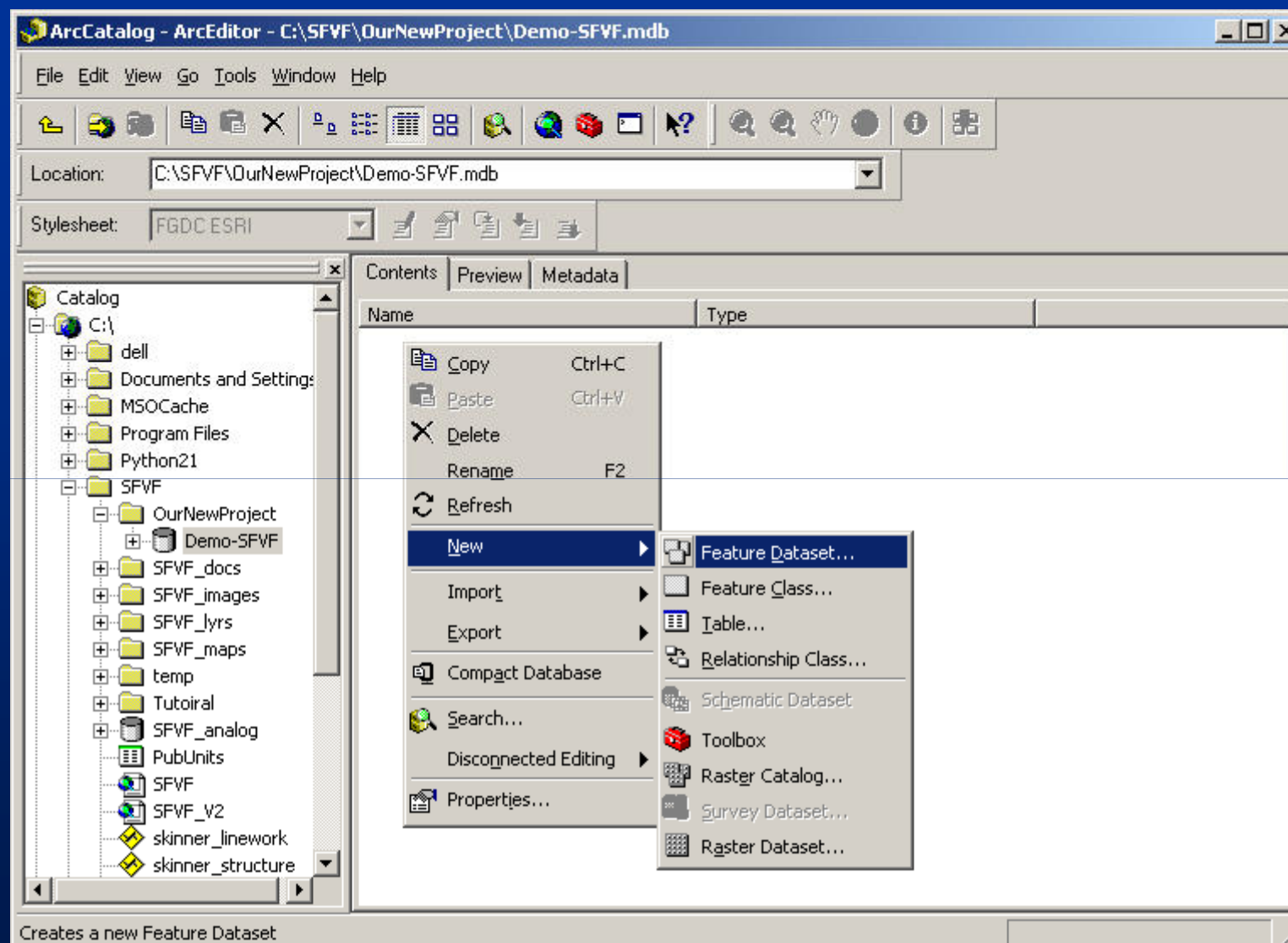


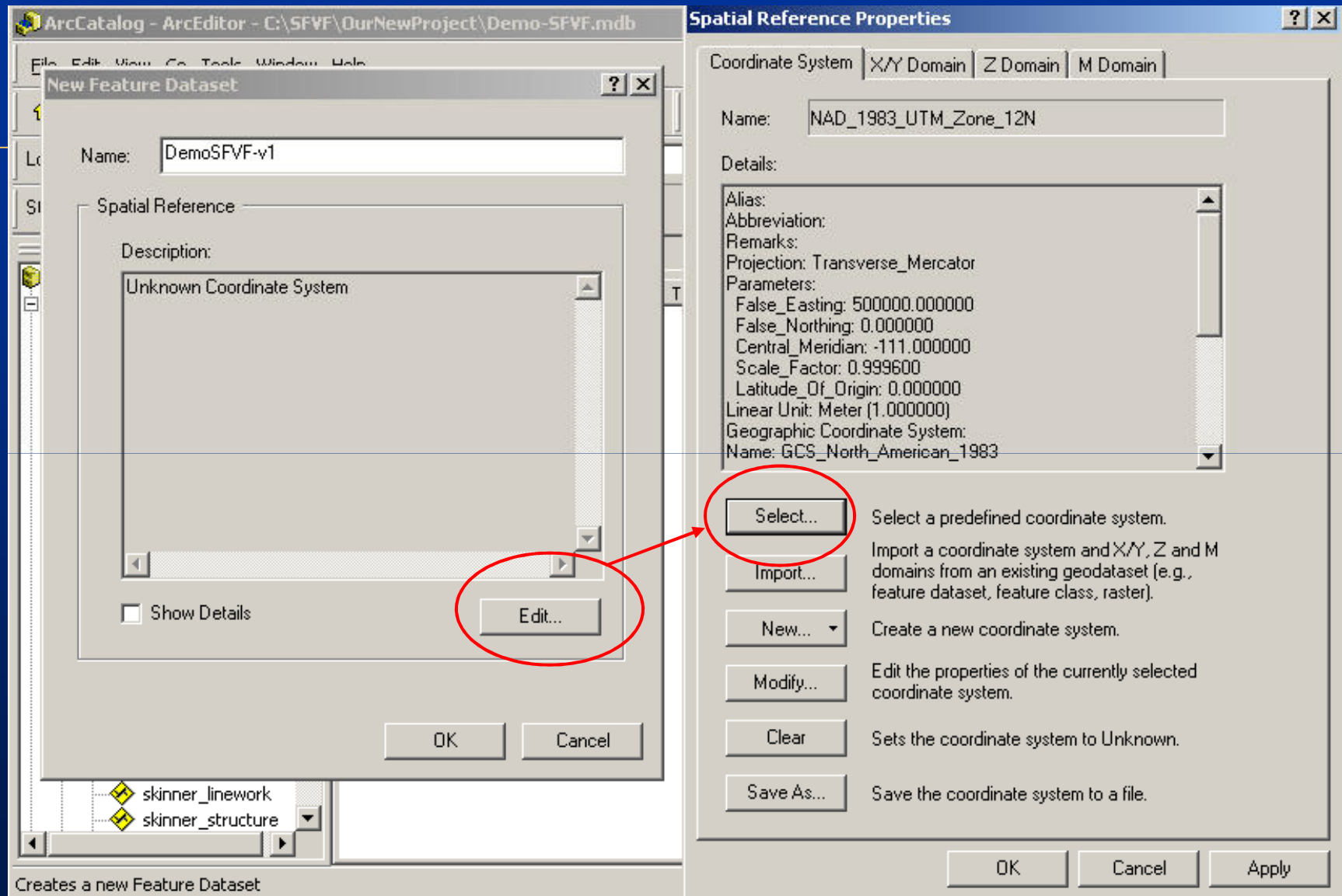


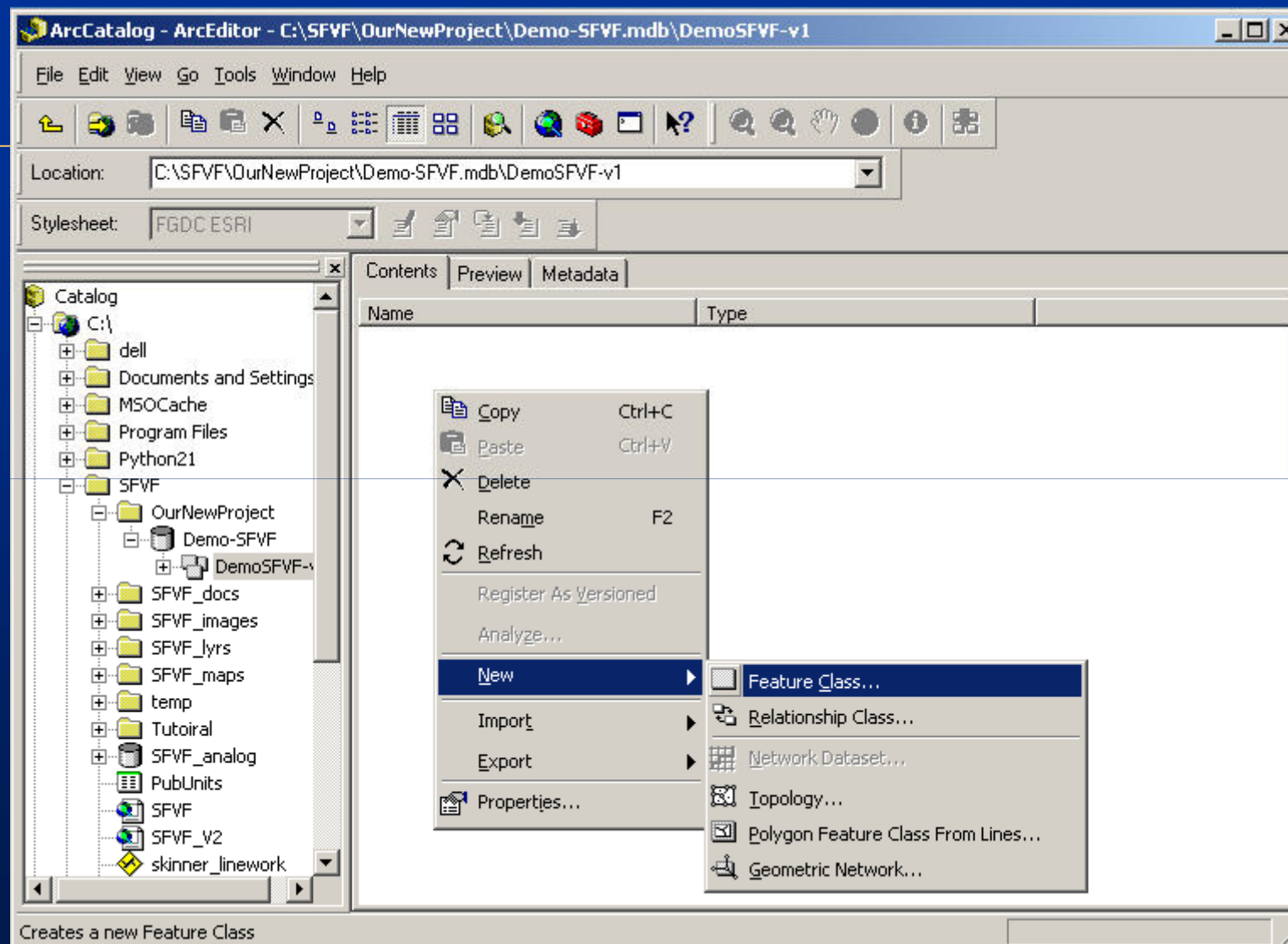
Basic Training

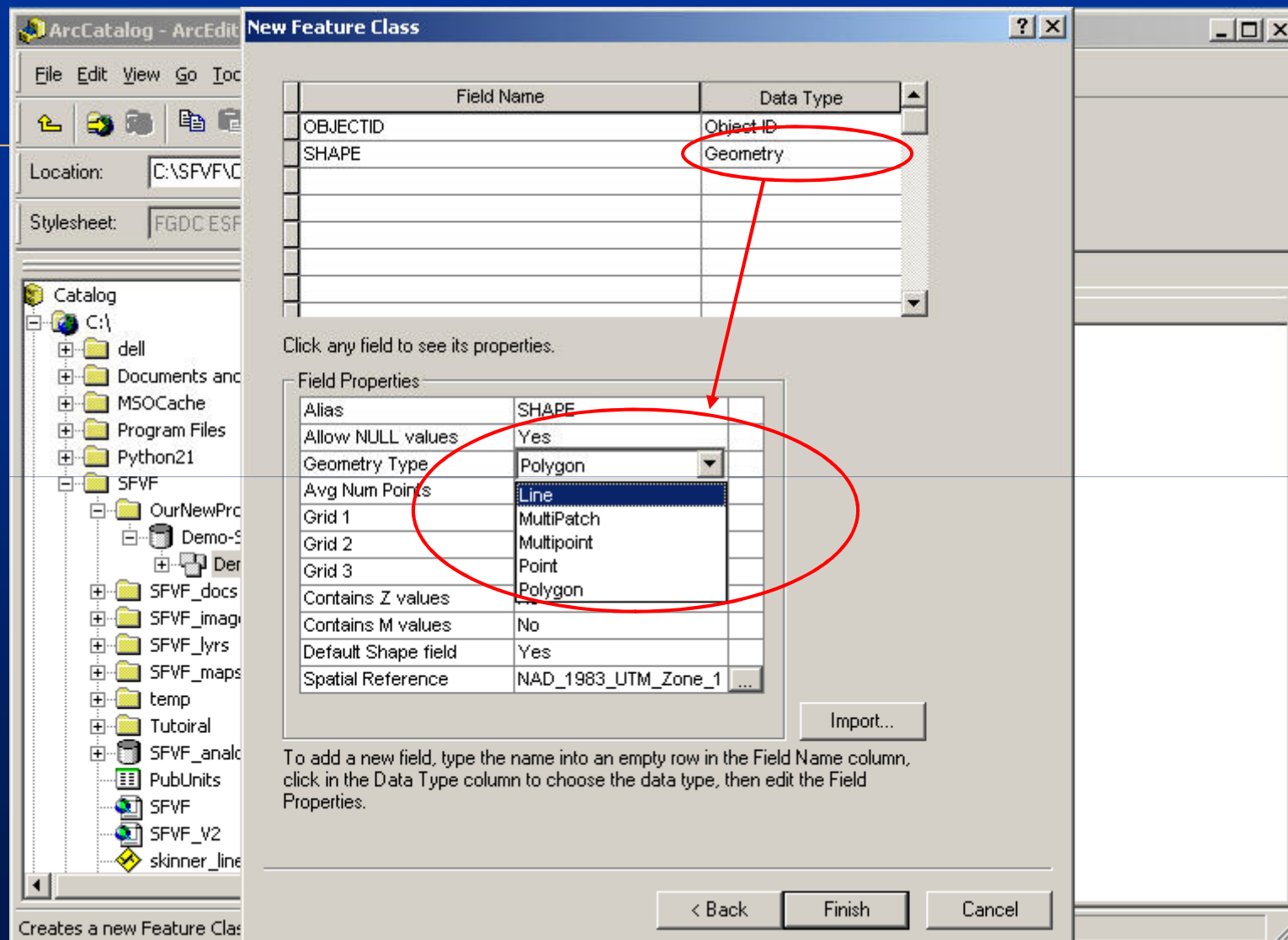
Feature Datasets

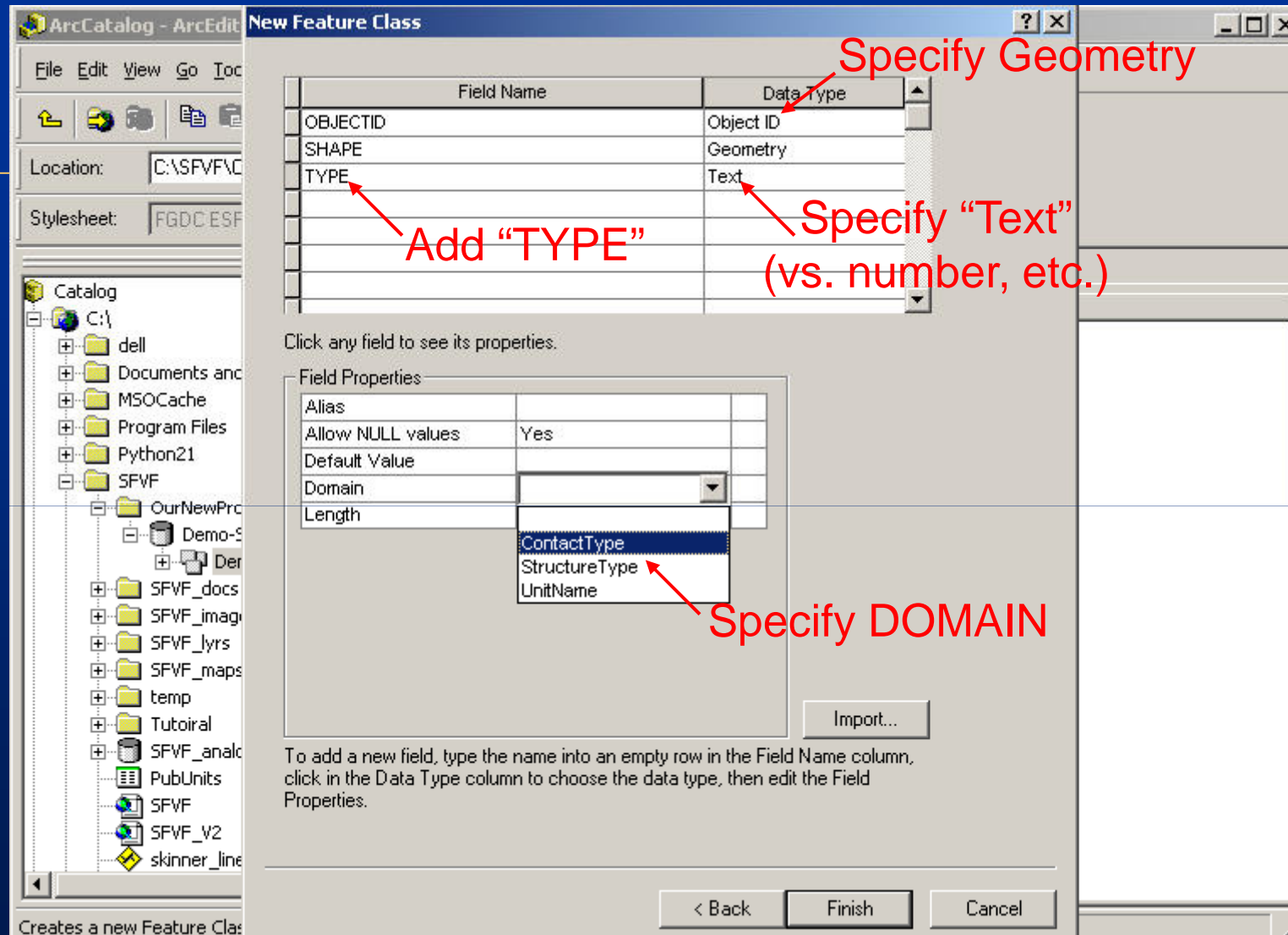
- Once the geodatabase created...
- And attribute domains set...
 - *Contacts*
 - *Structure*
 - *Temporary unit names*
- Create a group of affiliated spatial information ... a dataset of features (polygons, lines, points)

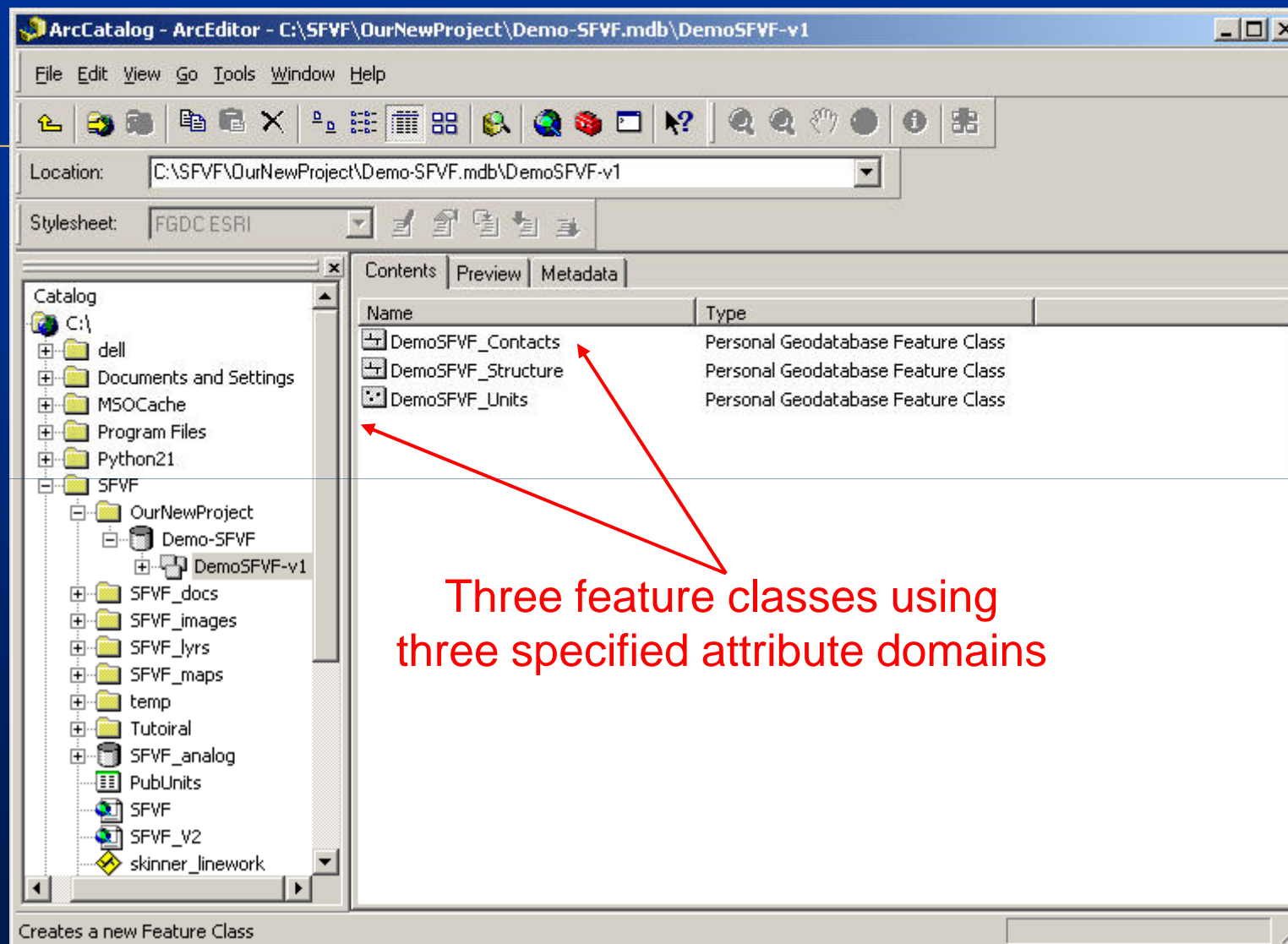












Basic Training

Geodatabase Components

- Good to have multiple projects (backups)
- Good to have multiple feature datasets
- Geodatabase easily transferable to colleagues

Break?
Who needs one?


Map, Edit, and Symbolize

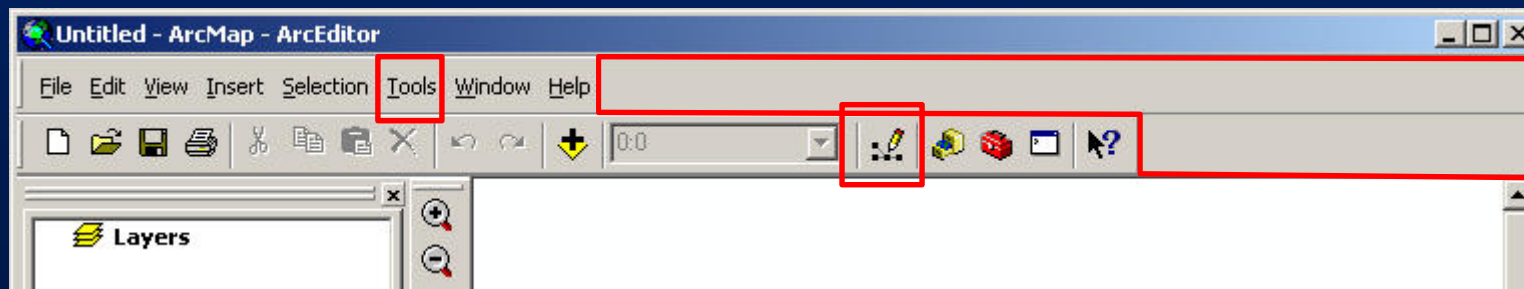
Map, Edit, and Symbolize

- Editor toolbar
- Advanced Editor toolbar
- Add feature classes (point and lines)
- Create point and line data
- Add attributes (from domains) to features
- Prepare lines before making polygons
- Build polygons from lines
- Use symbols to represent attributes

Map, Edit, and Symbolize

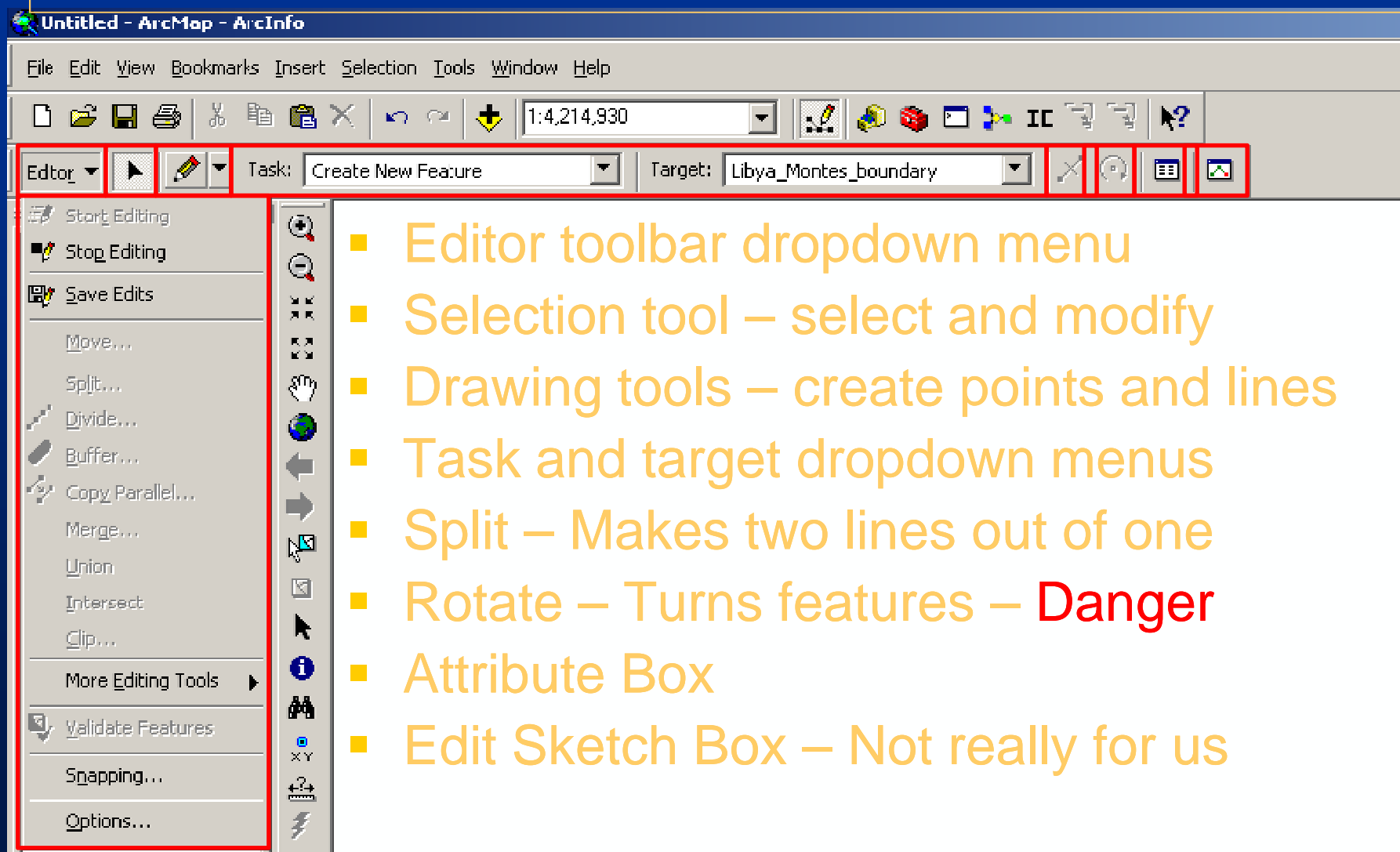
Editor Toolbar

- Ensure that ArcEditor is functional: 
 - Right-click empty ToolBar and select “Editor”
 - <or>
 - Tools → Customize → Editor (check)
 - Tools → Editor Toolbar (v. 9.3)
- Dock ArcEditor ToolBar onto ArcMap project



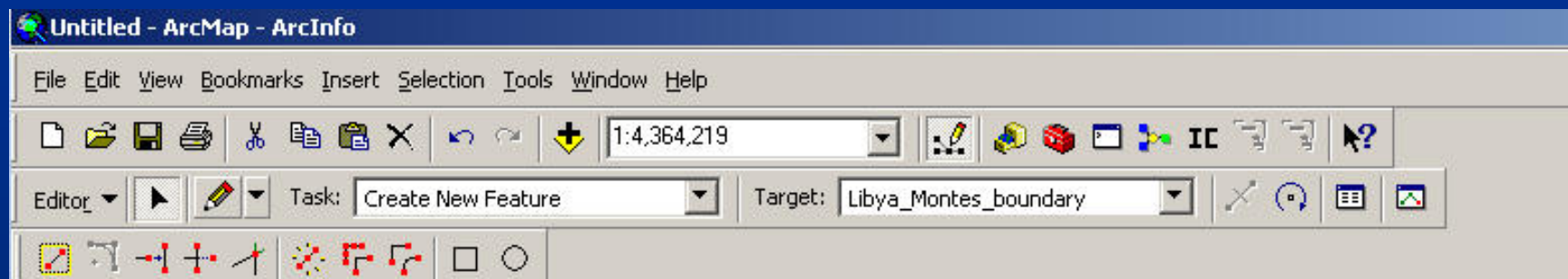
Map, Edit, and Symbolize

Editor Toolbar



Map, Edit, and Symbolize

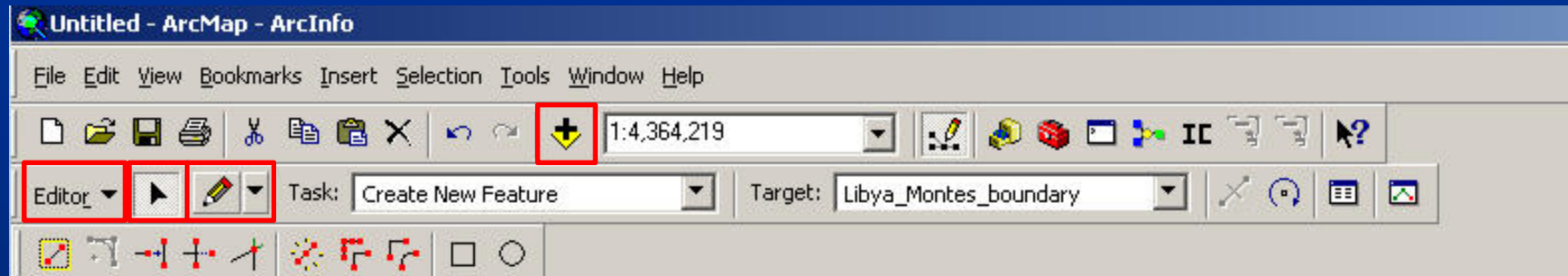
Advanced Editor Toolbar



- Copy Features Tool – Self explanatory
- Extend Feature – extends lines to touch nearest line
- Trim Feature – Trims overshoots back to an intersection
- Line Intersect – Places a node where 2 lines intersect
- Explode Feature – breaks apart multi-part features
- Generalize – reduces the # of vertices in a line
- Smooth – creates a best fit curve to the vertices
- Rectangle and Circle tools

Map, Edit, and Symbolize

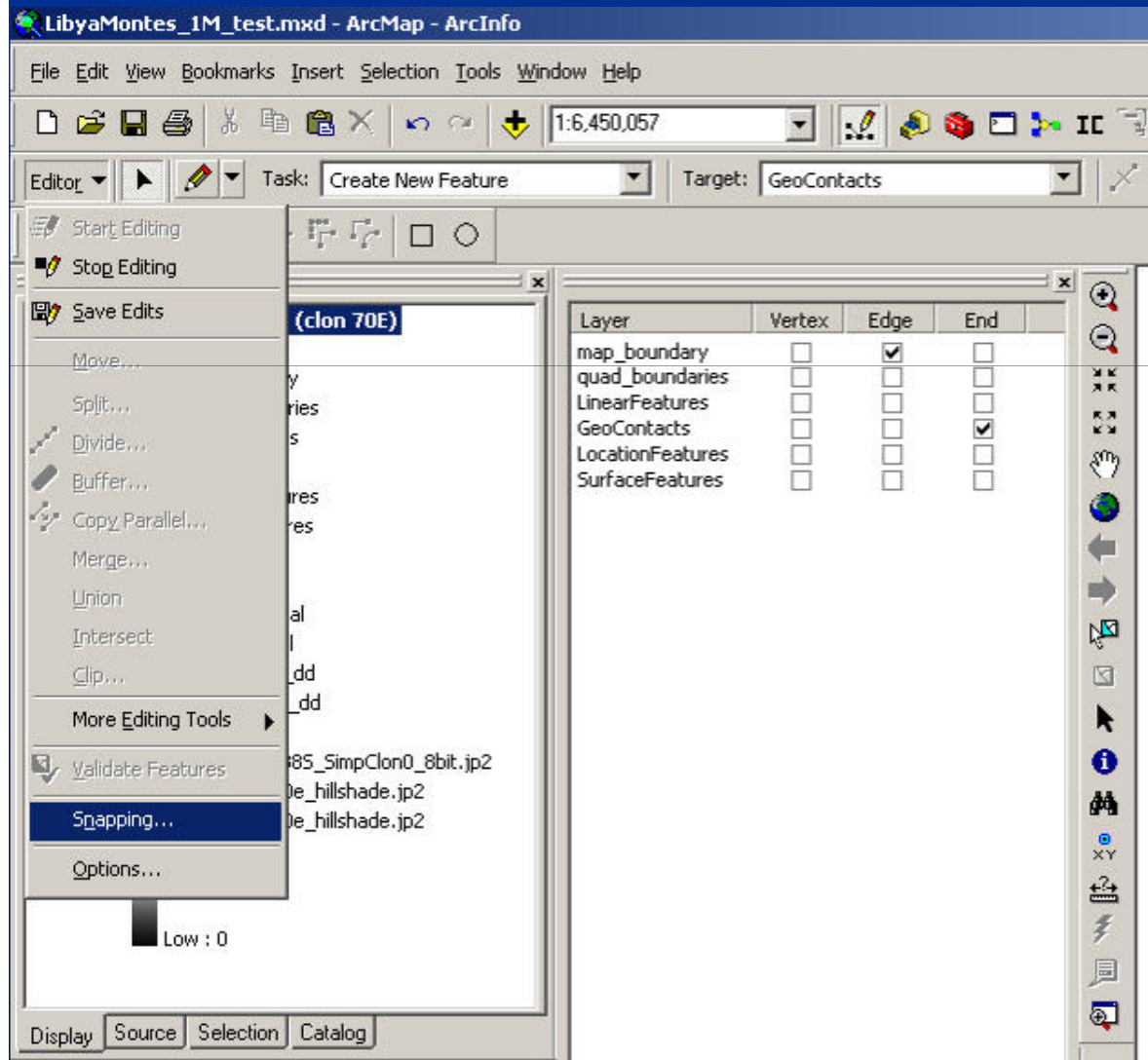
Creating and Editing Data



- Click the add data button
 - Navigate to the location of the data you want to edit
- Click on the editor dropdown menu and select “Start Editing”
 - If you have multiple layers from multiple locations, select correct layer
- To create a new feature, select the pencil tool and begin drawing
- To edit existing features, use the selection tool to select feature, and the dropdown and other edit commands to alter the feature

Map, Edit, and Symbolize

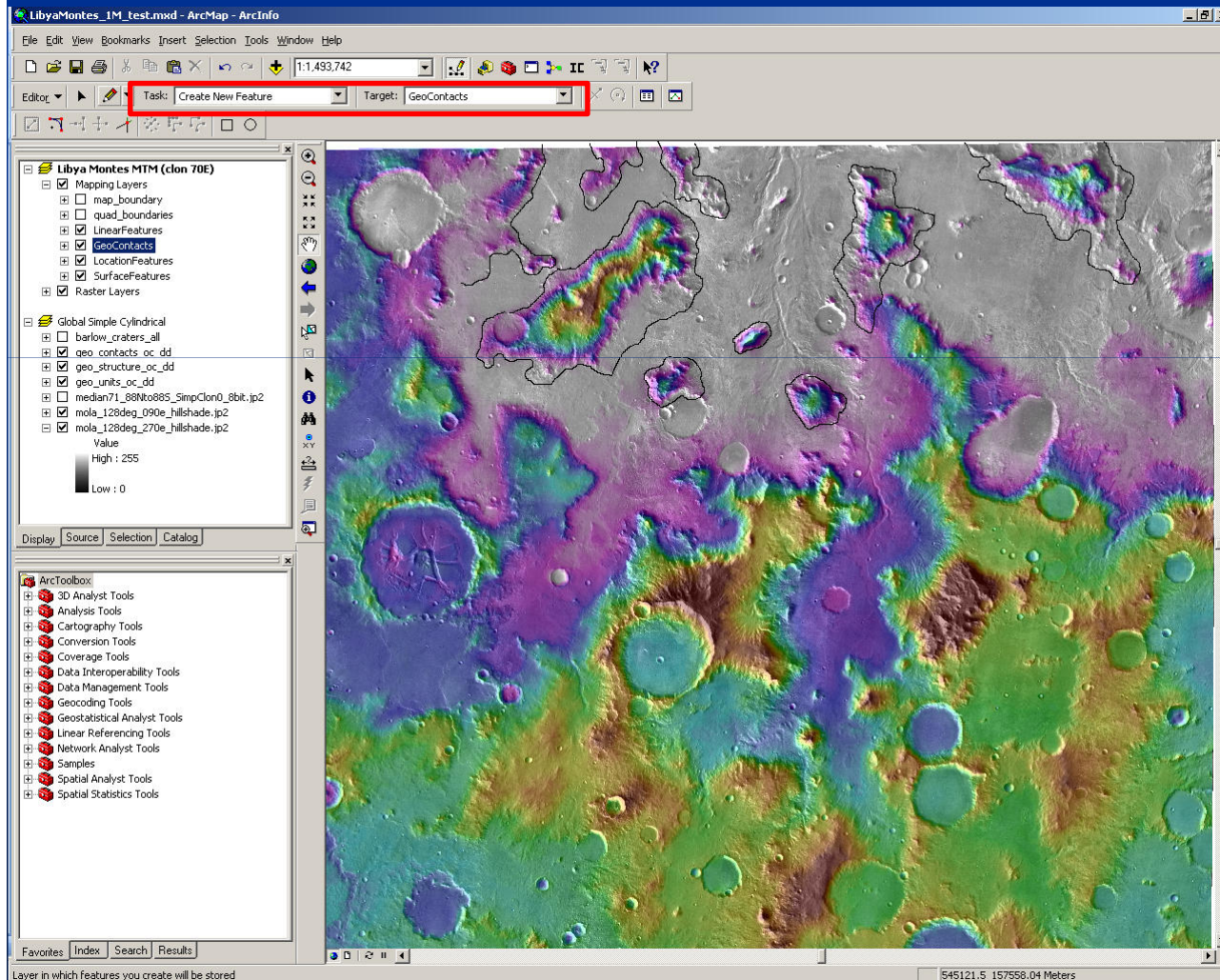
Creating and Editing Data



- Before you begin...
 - Set up snapping controls and tolerances

Map, Edit, and Symbolize

Creating and Editing Data

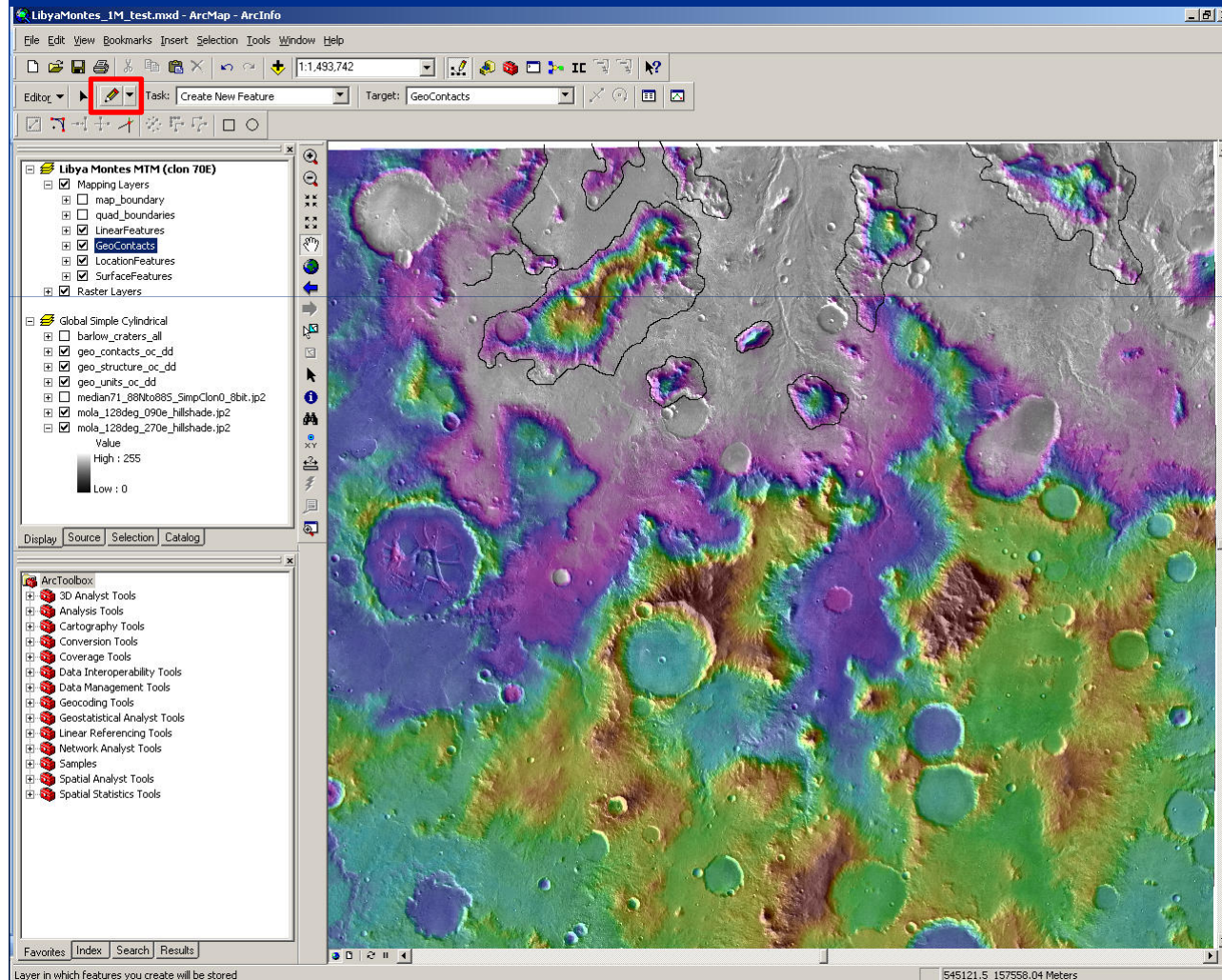


- Ensure task box is set to “Create New Feature”
- Ensure the target layer is the one to which you want to add new features

Map, Edit, and Symbolize

Creating and Editing Data

- Select the pencil tool and draw



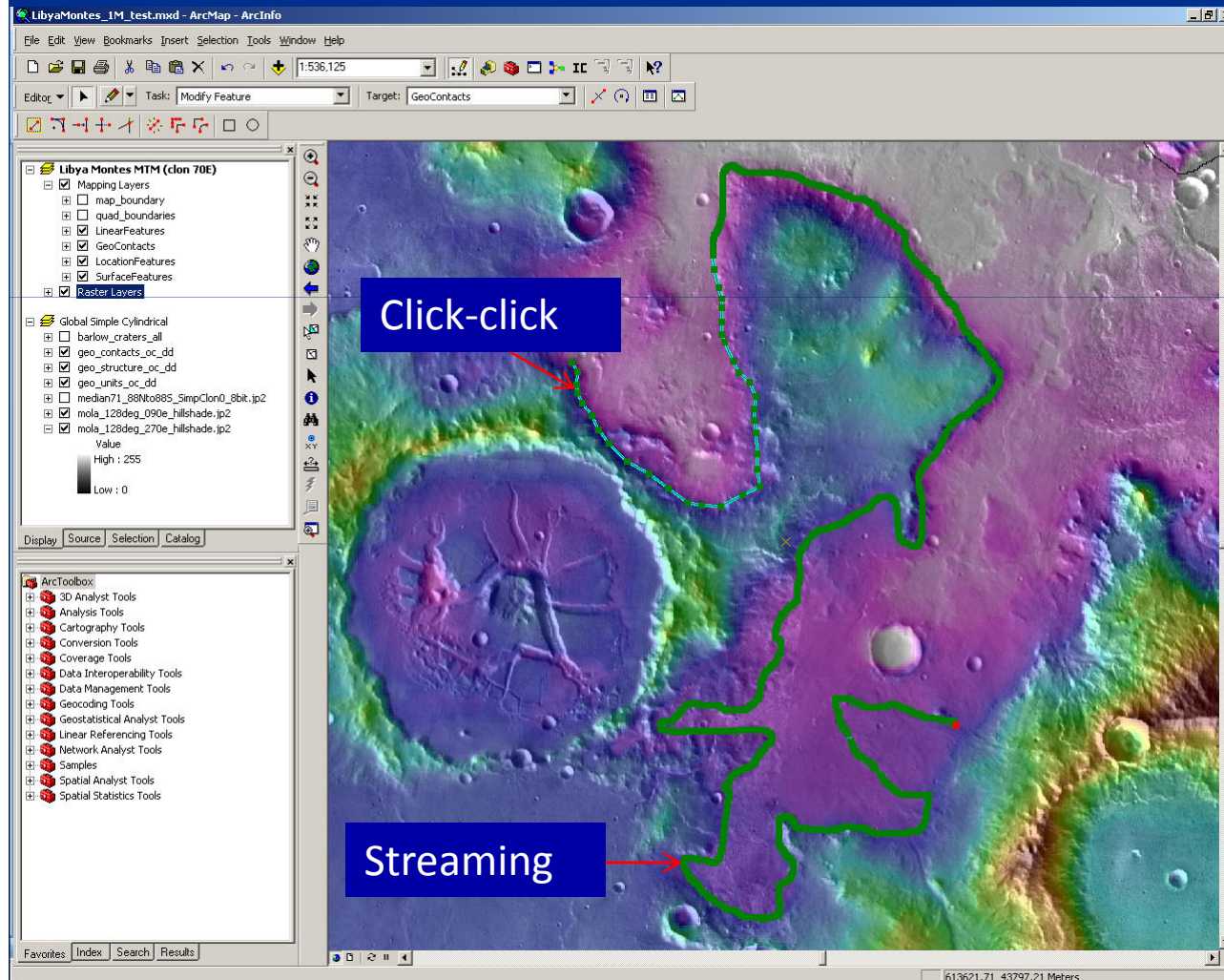
- 2 Options:

Click: click the mouse for vertices

Stream: vertices draw as you move the mouse;
Toggle F8

Map, Edit, and Symbolize

Creating and Editing Data



Click-click:

Pros: good for small areas, higher detail

Cons: Slow, harder to define curves and corners

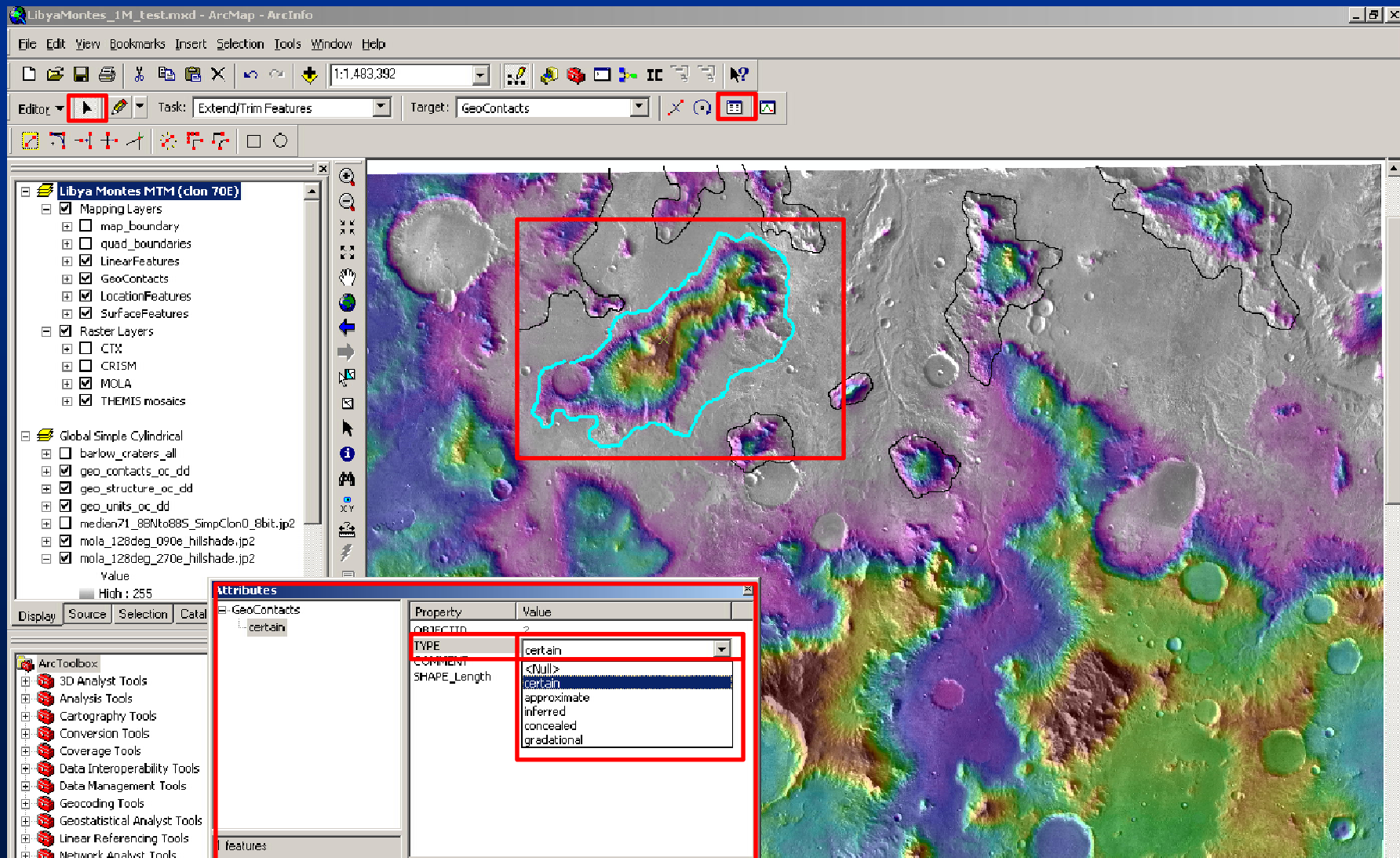
Stream:

Pros: Excellent for smaller-scale maps, adjustable tolerance, SPEEDY

Cons: Panning while drawing, too much detail

Map, Edit, and Symbolize

Adding Attributes



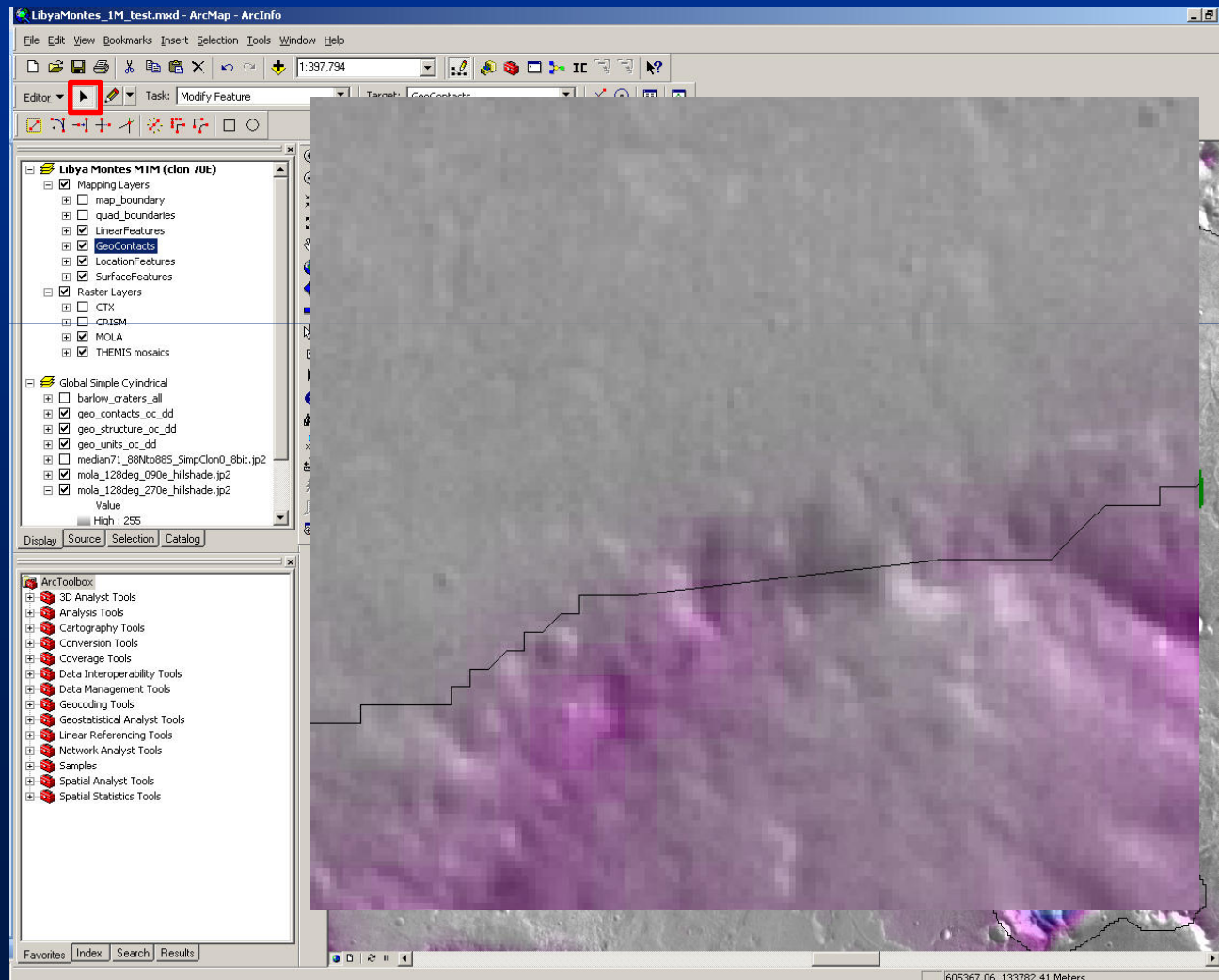
Map, Edit, and Symbolize

Editing

- Lines must define a discrete, enclosed area to generate a polygon
- It may be necessary for you to manually edit the linework
 - Snapping
 - Reshaping
 - Smoothing
- Check your snapping environment and tolerances before editing

Map, Edit, and Symbolize

Editing



Using the selection tool, double-click on the feature to modify so the vertices are displayed.

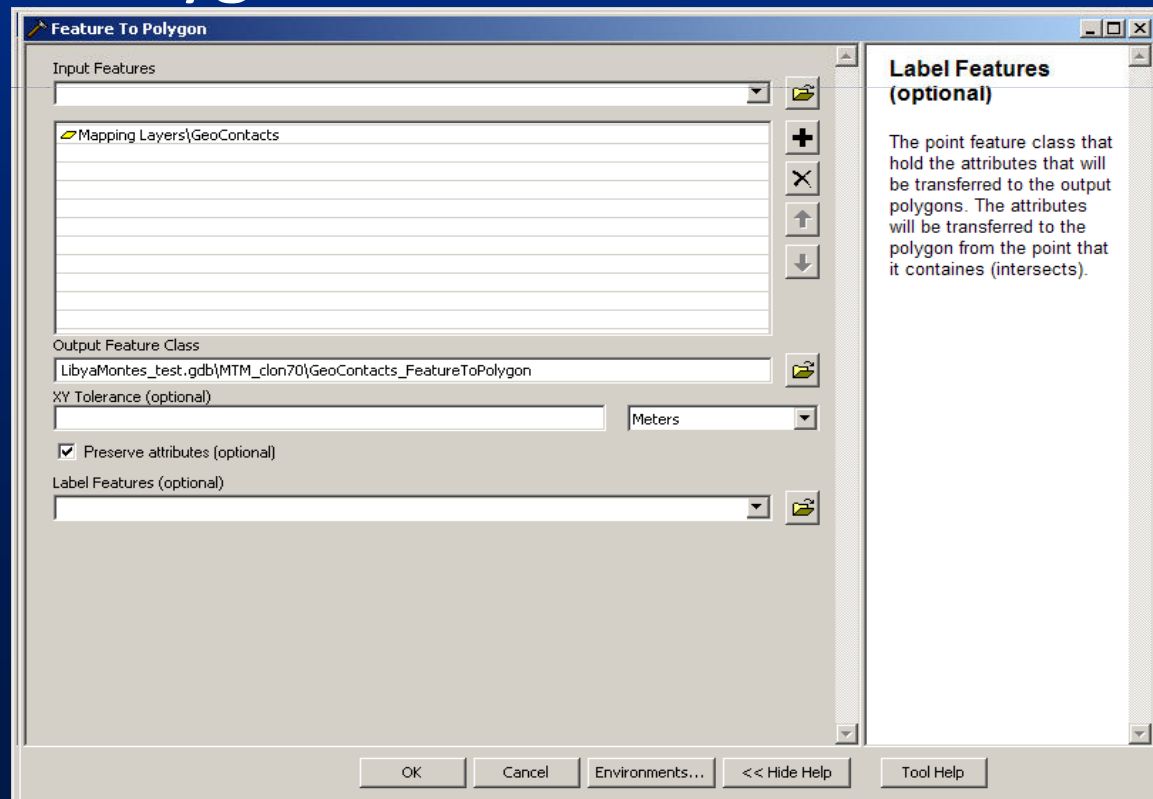
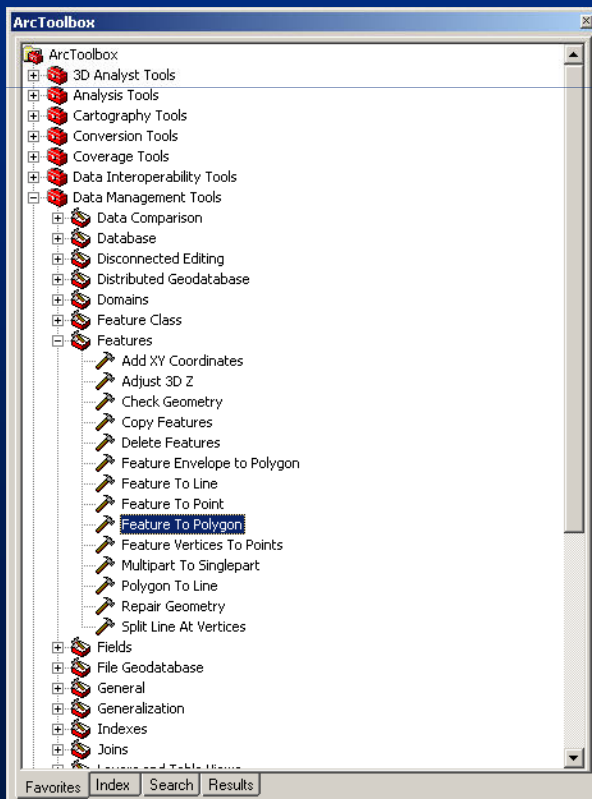
Position the cursor over the vertex to move, click and drag the vertex to the new location. Let go of the mouse button

If end, edge, or vertex snapping is turned on, the cursor will be dragged to a snapping location once it is within the specified tolerance

Map, Edit, and Symbolize

Building Polygons

- ArcToolbox Method
 - Under Data Management Tools → Features → Feature To Polygon



Map, Edit, and Symbolize

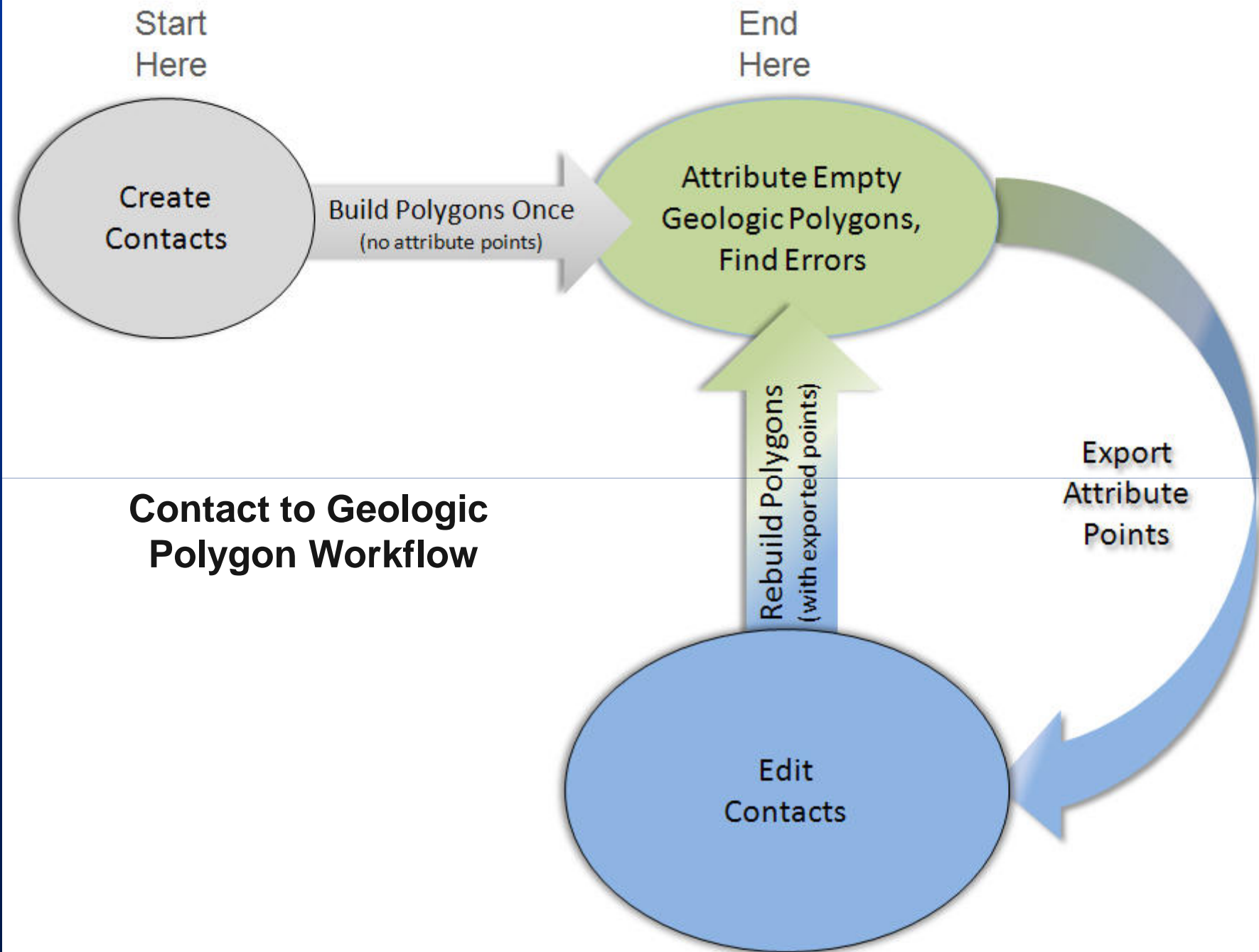
Building Polygons

- If you are not using the Editor version of ArcMap, there are 3rd party solutions to building polygons
- We don't draw polygons from the beginning::
 - *Polygons are difficult to edit (slivers, gaps, nested polygons, etc.)*
 - *Lines generated from polygons will have to be edited (split, merged, attributed, etc.)*
 - *It is easier and faster to draw, edit and attribute lines using ArcMap*

Map, Edit, and Symbolize

Building Polygons

- Recognize that building polygons from the contacts is an iterative process. You would be extremely lucky (i.e., the pope of GIS-town) to only have to do this once.
- If you have attributed a lot of your polygons and have to change a contact or fix a problem, you have not wasted your time. You can export and store the attributes as a point file. That point file can and will be used the next time you build polygons.



Map, Edit, and Symbolize

Symbolizing Features

- Using unique symbols for different attributes
 - Double click on the name of the feature in the Table of Contents

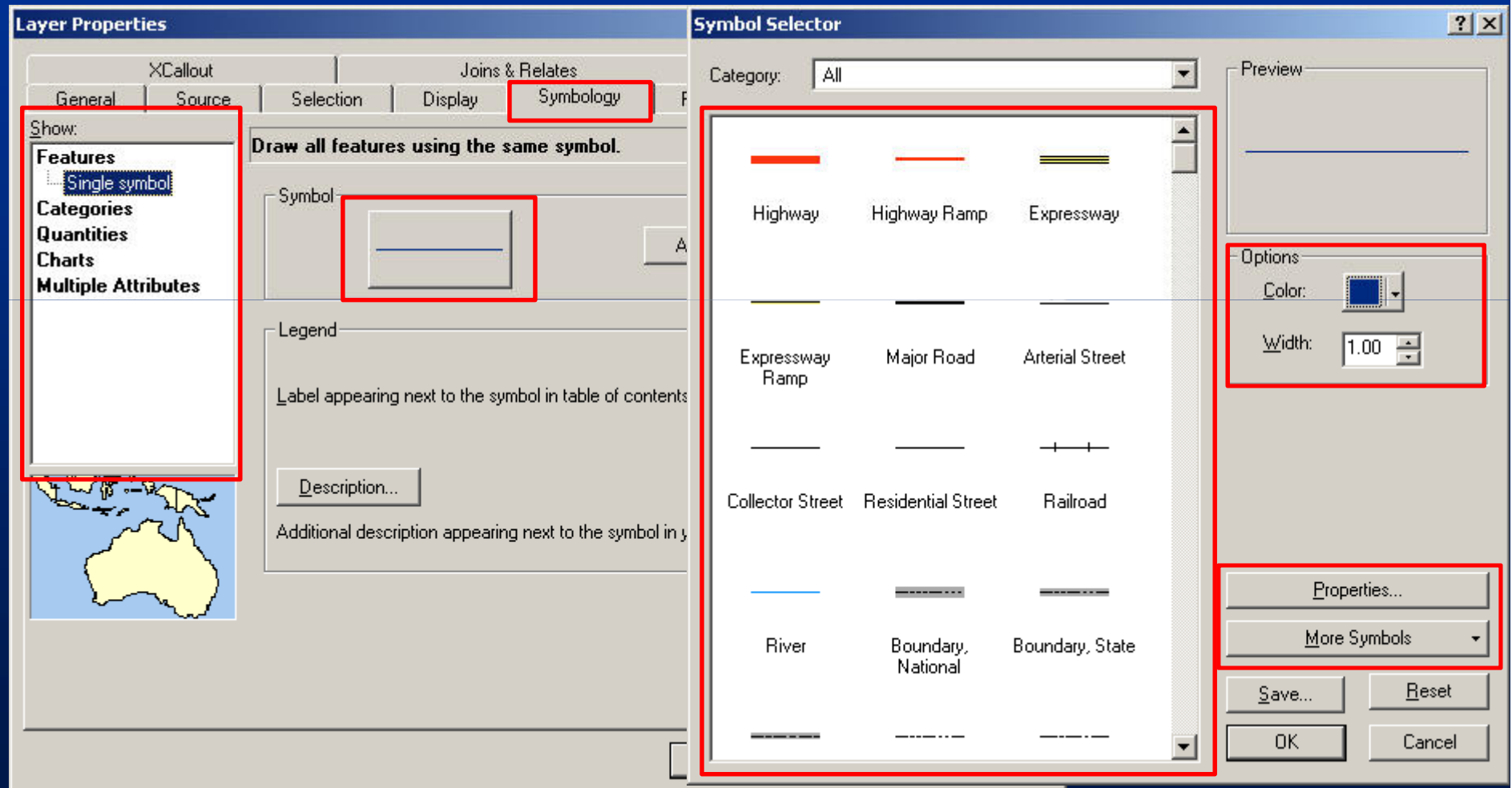
<or>

- Right click on the name of the feature in the Table of Contents, and select Properties

Choose the Symbology tab

Map, Edit, and Symbolize

Symbolizing Features



Map, Edit, and Symbolize

Symbolizing Features

Layer Properties

General | Source | Selection | Display | **Symbology** | Fields | Definition Query | Labels

Show:

- Features
 - Categories**
 - Unique values**
 - Unique values, many I
 - Match to symbols in a
 - Quantities
 - Charts
 - Multiple Attributes

Draw categories using unique values of one field. **Import...**

Value Field: TYPE

Color Ramp: [Color Ramp]

Symbol	Value	Label	Count
<input checked="" type="checkbox"/>	<all other values>	<all other values>	
<Heading>			
TYPE			
————	certain	certain	
—— —	approximate	approximate	
.....	concealed	concealed	
	gradational	gradational	
-----	inferred	inferred	

Add All Values | Add Values... | Remove | Remove

Import Symbolology from Layer

Look in: Libya_working_test

Name	Type
GeoContacts.lyr	Layer
LinearFeatures.lyr	Layer
LocationFeatures.lyr	Layer
SurfaceFeatures.lyr	Layer

Name: [Text Box] Add

Show of type: Layer files (*.lyr) Cancel

Break?
Who needs one?

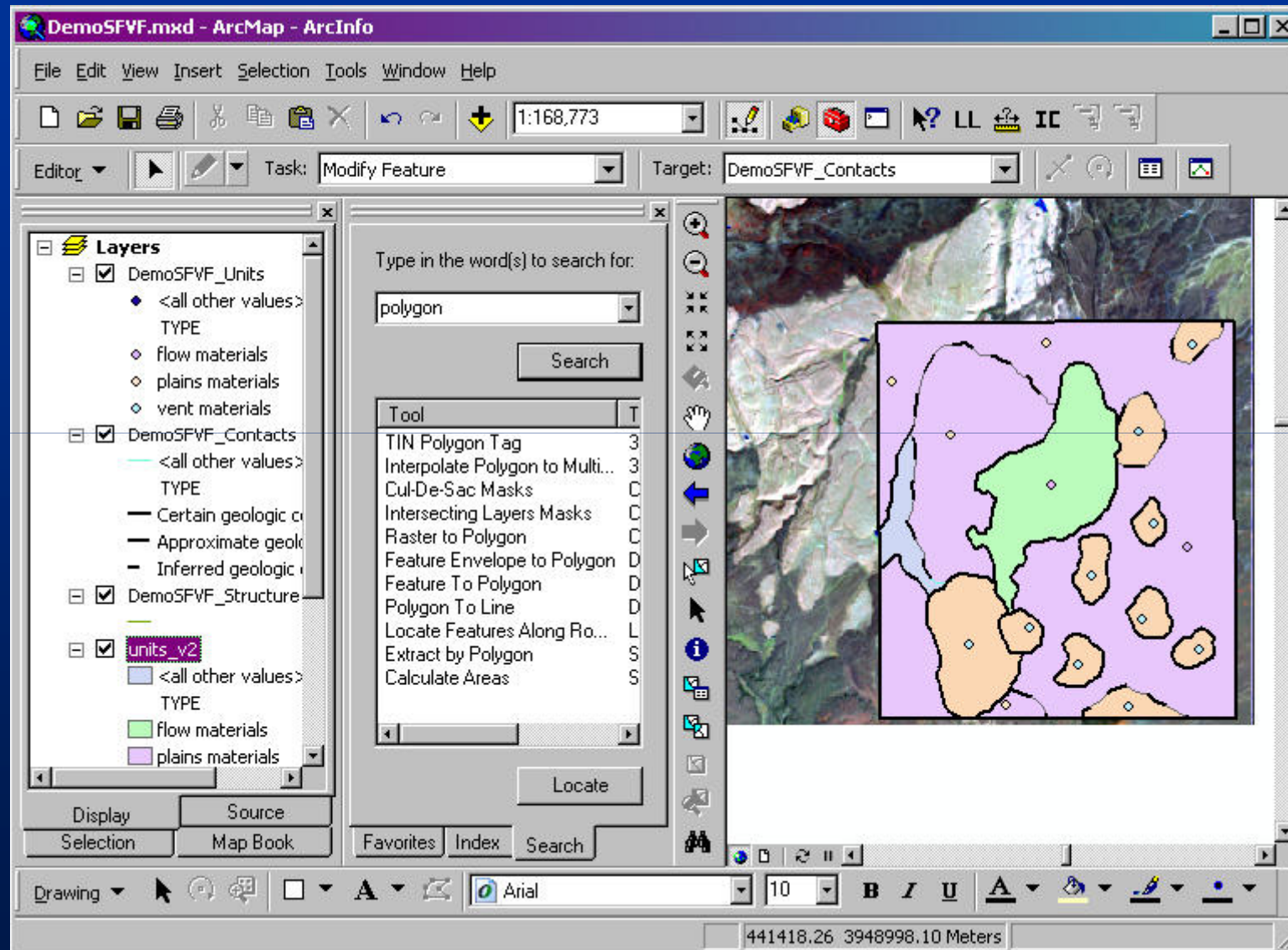
Query and Spatial Analysis

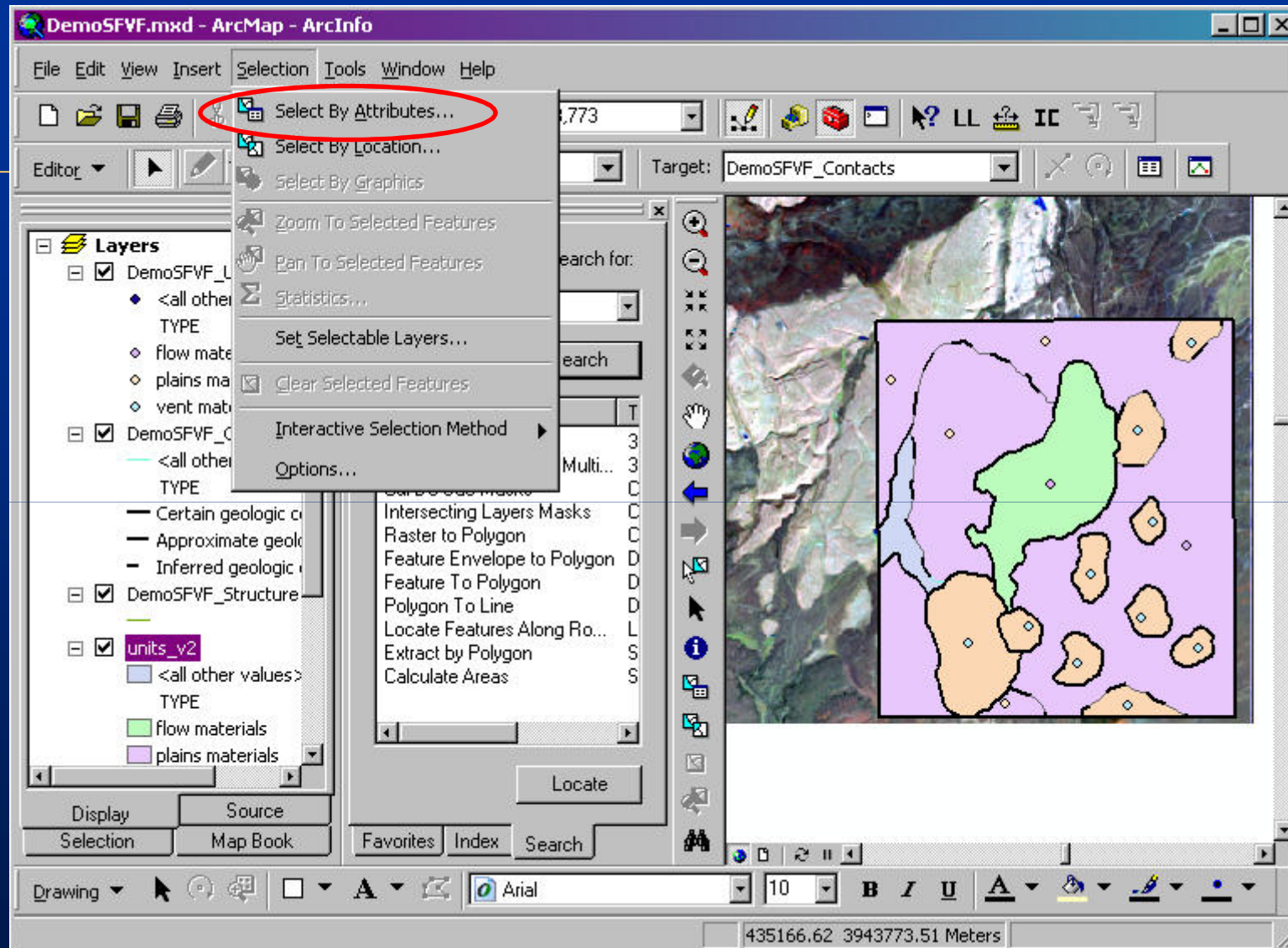
Query and Spatial Analysis

Querying Data

- GIS empowers the user to perform spatial searches across any or all data within a project
- A “query” is *“a request to select features or records from a database or feature”*
- Very easy “question-driven” dialog boxes allow user to string together multiple queries
- Queries are most easily performed using a dialog box in ArcMap

Suppose in the example below that the user wants to find all units that are labeled “plains material”. The user will need to query the data as follows...





Selecting by feature attributes

- Select the layer and field that the query will be based on
- “Get Unique Values” will give all values in that field
- Build the query and click “OK”

The screenshot shows the 'Select By Attributes' dialog box. The 'Layer' dropdown is set to 'units_v2'. The 'Method' dropdown is set to 'Create a new selection'. A list of fields is shown: [OBJECTID], [TYPE], [SHAPE_Length], and [SHAPE_Area]. The 'Is' button is selected. The 'Get Unique Values' button is also visible. Below the buttons, the SQL query is displayed: `SELECT * FROM DemoSFVF_v1.units_v2 WHERE: [TYPE] = 'Plains materials'`. The 'OK' button is highlighted.

Layer: units_v2

☐ Only show selectable layers in this list

Method: Create a new selection

[OBJECTID]
[TYPE]
[SHAPE_Length]
[SHAPE_Area]

= < > Like
> > = And
< < = Or
? * () Not
Is

"
'Flow materials' - flow materials
'Plains materials' - plains materials
'Vent materials' - vent materials

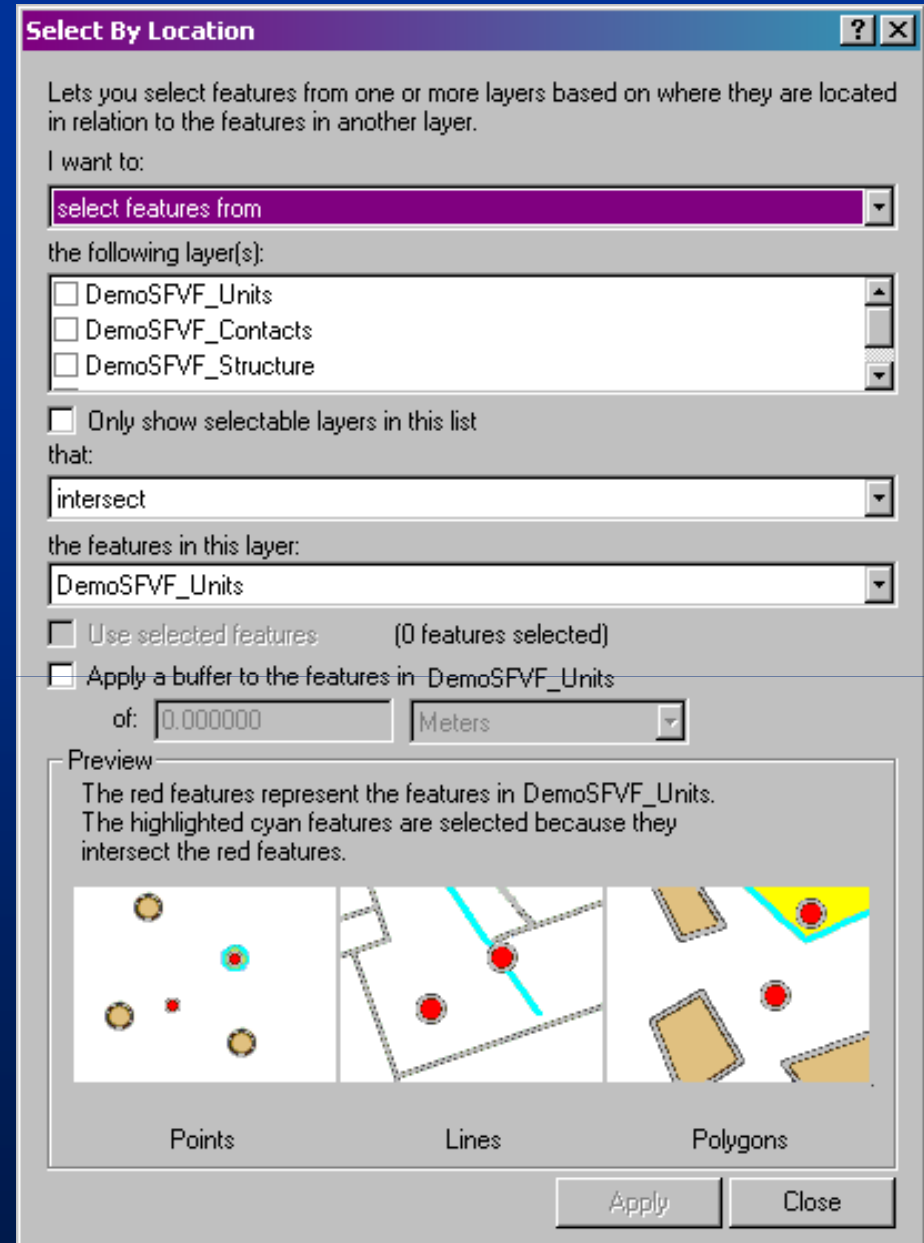
Get Unique Values Go To:

SELECT * FROM DemoSFVF_v1.units_v2 WHERE:
[TYPE] = 'Plains materials'

Clear Verify Help Load... Save...
OK Apply Close

Selecting by feature location

- Features can be selected based on relationships with other features
- Examine the “Select by Location” window for specifics



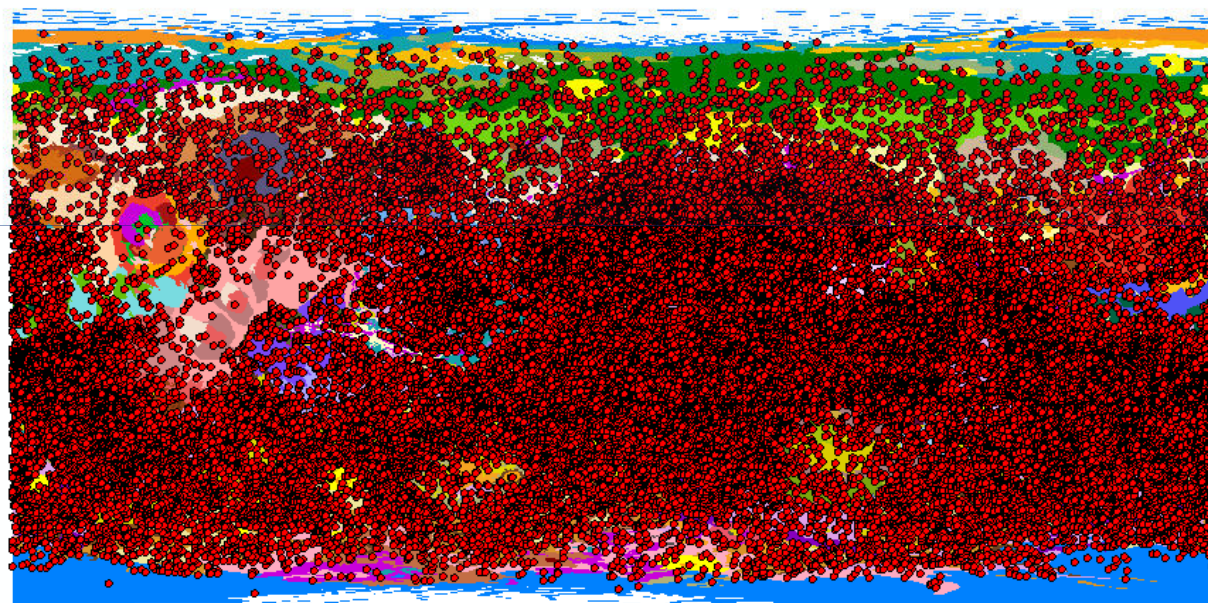
Multiple Query for Analysis

- “Attribute” and “Location” selection tools and summary tools can be used in series for robust data mining
- Crater Count example: “Suppose a user wants to know the total number and summary statistics of craters that have rim diameters between 5 and 16 that reside on Amazonian age geologic units”
 - *Select by attribute from crater database those craters that have diameters between 5 and 16.*
 - *Select by attribute from geologic map those units that are Amazonian in age (crater selection will be preserved).*
 - *Select by location the selected craters that intersect the selected geologic units.*
 - *Summarize crater diameter field.*

Mars crater count example

Crater database

Global geologic map



Untitled - ArcMap - ArcInfo

File Edit View Insert Selection Tools Window Help

1:177,424,426

Georeferencing Layer: Task: Create New Feature Target:

Layers

- barlow
- geo_un

Right-click target layer and select "Open Attribute Table" to verify selection.

Note that selected features are highlighted blue

Attributes of barlow_craters_all

FID	Shape	SUBQUAD	ID	LATITUDE	LONGITUDE	DIAMETER	TERRAIN	TYPE	EJECTA_MOR	INTERIOR_M	PIT_DIAMET	MIN_DIAMET	ANGLE	COMMENTS
0	Point	01A	1	78.46	-12.79	13.8	PyL	Rc	No	No	0	0	999	none
1	Point	01A	2	78.1	-15.9	7.1	PyL	Rc	No	No	0	0	999	none
2	Point	01A	3	78.39	-27.34	19.5	PyL	Rc	SL	Un	0	0	999	none
3	Point	01A	4	77.97	-67.43	8.7	PyL	Rc	No	No	0	0	999	none
4	Point	01A	5	81.62	-170.75999	16.2	PyL	Rc	No	No	0	0	999	none
5	Point	01A	6	81.62	-170.75999	16.2	PyL	Rc	No	No	0	0	999	none
6	Point	01A	7	82.96	-47.15	11	PCp	Dc	No	No	0	0	999	none
7	Point	01A	8	82.62	-57.22	19.7	PCp	Sc	No	No	0	0	999	none
8	Point	01A	9	81.12	-105.92	17.9	PCp	Dc	No	No	0	0	999	none
9	Point	01A	10	80.78	-115.99	12.4	PCp	Sc	No	No	0	0	999	none
10	Point	01A	11	78.44	-115.99	12.4	PCp	Sc	No	No	0	0	999	none
11	Point	01A	12	77.75	-153	12.4	PCp	Sc	No	No	0	0	999	none

Attribute table showing selected features

Records (26652 out of 42284 Selected)

Do same for geologic unit features...

Georeferencing Layer: 100%

Layers

- ☐ barlow_craters_all
- ☒ geo_units_oc_dd

Select By Attributes

Layer: geo_units_oc_dd

☒ Only show selectable layers in this list

Method: Create a new selection

"FID"
"UnitName"
"UnitSymbol"
"AreaSinkM2"
"X"
"Y"

= <> Like 'Aha'
> >= And 'AHa'
< <= Or 'AHc'
_ % () Not 'AHh'
Is Get Unique Values Go To: 'AHpe'
'AH'
'AH3'

SELECT * FROM geo_units_oc_dd WHERE:
"UnitSymbol" LIKE 'A%'

Clear Verify Help Load... Save... OK Apply Close

Attributes of barlow_craters_all

FID	Shape	SUB
0	Point	01A
1	Point	01A
2	Point	01A
3	Point	01A
4	Point	01A
5	Point	01A
6	Point	01A
7	Point	01A

Record: 1 Show: All Selected Records (26652 out of 42284 Selected)

Attributes of geo_units_oc_dd

FID	Shape	UnitName	UnitSymbol	AreaSinkM2	X	Y
0	Polygon	polar ice deposits	Api	588743	-0.000025	78.750712
1	Polygon	polar ice deposits	Api	133.117	-15.616227	-85.793247
2	Polygon	polar ice deposits	Api	451.702	-2.586578	-85.781298
3	Polygon	polar ice deposits	Api	4155.77	21.047073	-86.887159
4	Polygon	polar ice deposits	Api	142.065	-86.171335	-85.297941
5	Polygon	polar ice deposits	Api	2208.05	-91.9	
6	Polygon	polar ice deposits	Api	221.44901	-29.5	

Record: 18 Show: All Selected Records (477 out of 2878 Selected)

Selected craters

Selected units

Display Source Selection

37°59'44.565"W 177°56'47.579"N

Untitled - ArcMap - ArcInfo

File Edit View Insert Selection Tools Window Help

1:177,424,426

XTools Pro

Georeferencing Layer

Layers

- barlow_craters_all
- geo_pts_oc_dd

Note that the pattern of selected features makes sense for the requested query. Good error check. Good for figure, etc.

Right-click target features (craters) and "Show Attribute Table"

Right-click on target field (diameter) and click "Statistics"

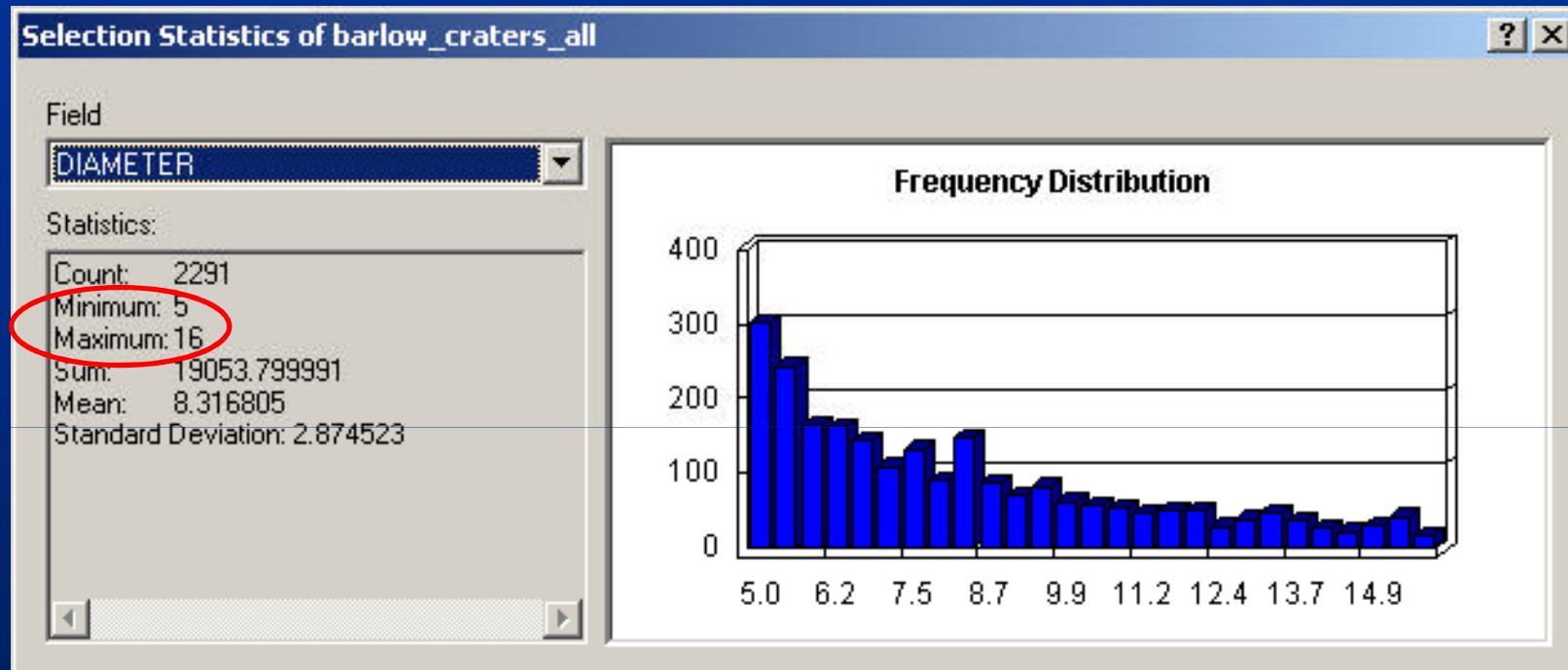
Attributes of barlow_craters_all

FID	Shape	SUBQUAD	ID	LATITUDE	LONGITUDE	DIAMETER	TERRAIN	TYPE	EJECTA	MOR	INTERIOR_M	PIT_DIAMET	MIN_DIAMET	ANGLE	COMMENTS
0	Point	01.A	1	78.46	-12.79					No		0	0	999	none
1	Point	01.A	2	78.1	-15.9					No		0	0	999	none
2	Point	01.A	3	78.39	-27.34					Un		0	0	999	none
3	Point	01.A	4	77.97	-67.43					No		0	0	999	none
4	Point	01.A	5	77.97	-119.81					Un		0	0	999	none
5	Point	01.A	6	81.62	-170.75999					No		0	0	999	none
6	Point	01.A	7	82.96	-47.15					No		0	0	999	none
7	Point	01.A	8	82.62	-57.22					No		0	0	999	none
8	Point	01.A	9	81.12	-105.92					No		0	0	999	none
9	Point	01.A	10	80.78	-115.38					No		0	0	999	none
10	Point	01.A	11	78.44	-136.25					No		0	0	999	none
11	Point	01.A	12	77.75	-153.92999					No		0	0	999	none
12	Point	01.A	13	77.57	-165.00					No		0	0	999	none

Record: 0 Show: All Selected

Options

Statistics only computed for selected features.



Summary: There 26,652 impact between 5 and 16 km rim diameter. Of those, 2291 occur on Amazonian geologic units. These average 8.3 km in diameter and have a standard deviation of 2.9 km.

Calculating Spatial Statistics

- A powerful tool to calculate statistics of a zone dataset (e.g., *geologic units*) based on values from a raster dataset (e.g., *elevation*)
- Spatial Analyst
 - *Cell statistics*
 - *Neighborhood statistics*
 - *Zonal statistics – covered here*
- Operates out of Spatial Analyst
 - *Right click empty space on tool bar and select “Spatial Analyst”*

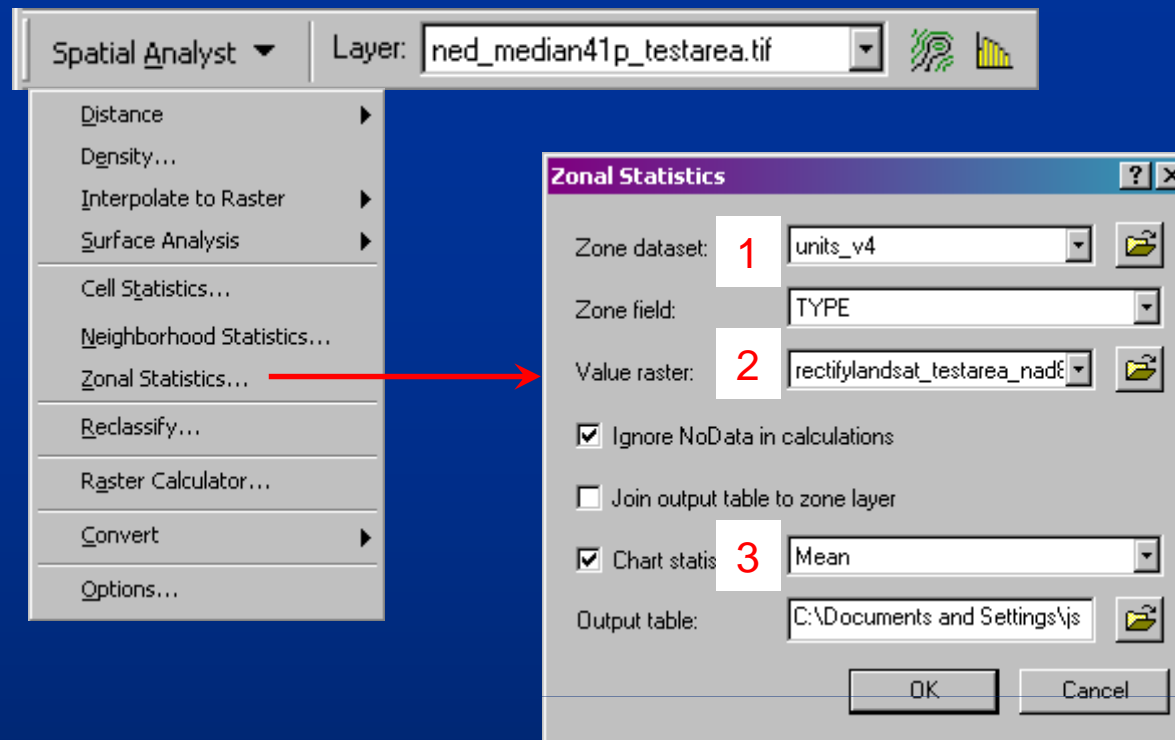


Zonal Statistics

- A function that summarizes values in a raster within the zones of another layer
- The user specifies the “zone dataset” (e.g., geologic units) the value raster dataset (e.g., slope)
- Output is a Table that summarizes zone statistics
- For example, the user could find the range and mean value of slope for geologic units



“The Zonal Statistics function allows the user to produce a simplified graph of the statistics. Note the check box in the dialog box.”



- 1. Set the Zone dataset (the feature that contains the region upon which statistics need to be created)
- 2. Set the Value raster (the raster dataset that will be the base of the statistics)
- 3. Set the statistic that is required (can be minimum, maximum, range, sum, mean, std dev, variety, majority, minority, median)

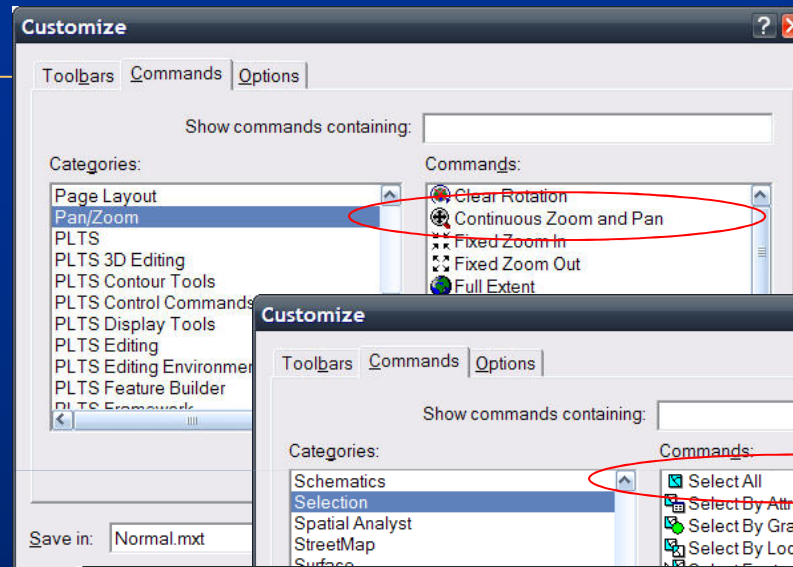
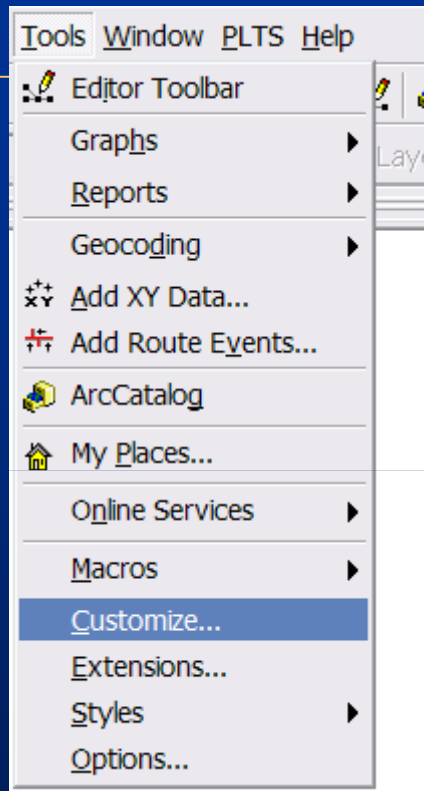
GIS Tools

Customizing ArcMap

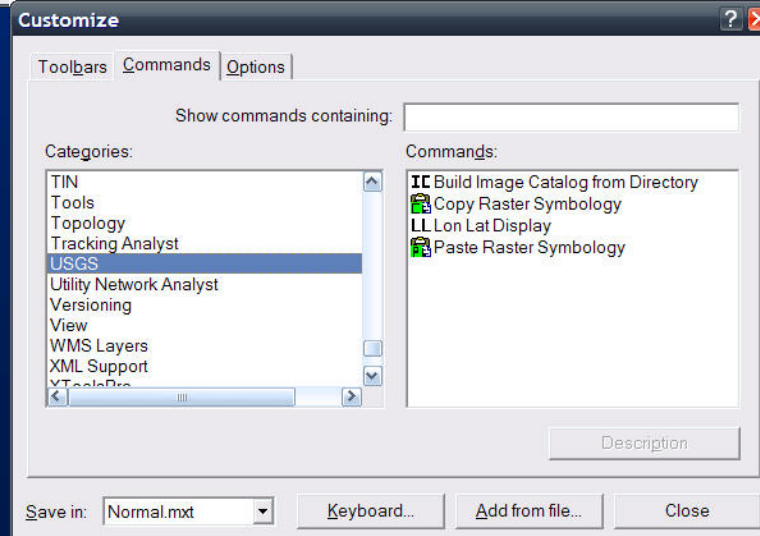
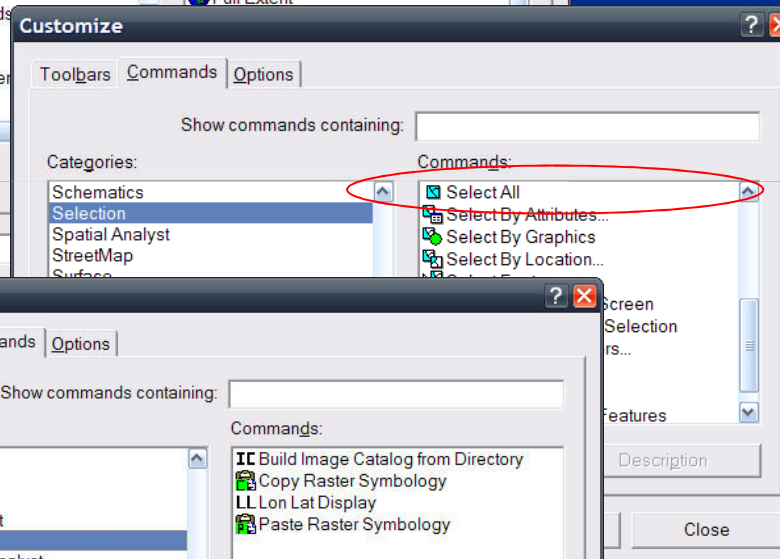
4 Methods for adding functionality

- Add built in buttons to menus
- Install downloaded programs
 - DLL libraries
 - Tools (python)
- Calculator scripts
- Create buttons/macros for custom tools

Add built in buttons to menus



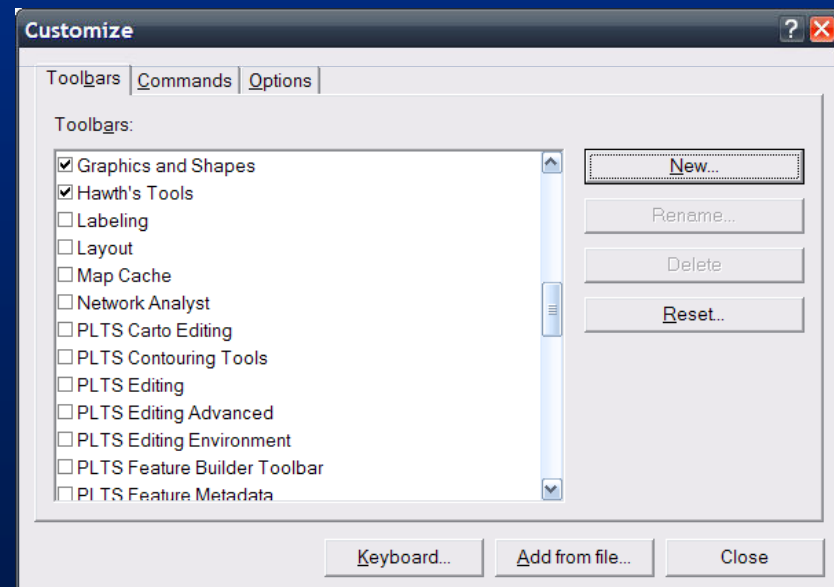
Commands Tab
Drag icon to
toolbar



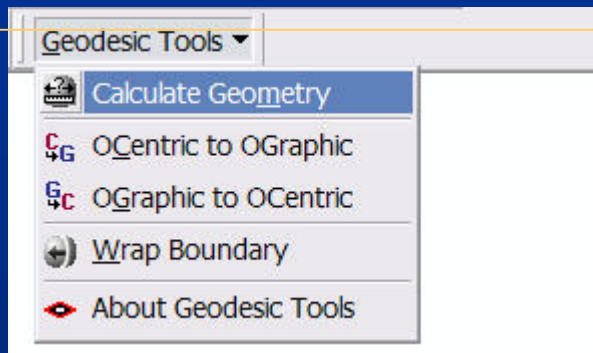
Install downloaded programs

- Many add-ons available for ArcMap (e.g. **X-Tools**, Hawth Tools, ArcHydro, etc.)
- These install like other programs (admin)

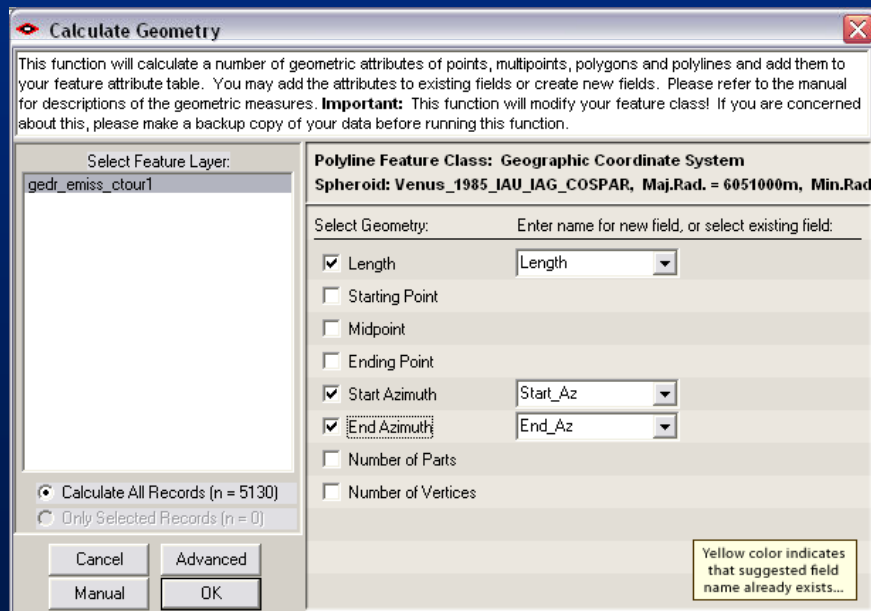
After the program is installed,
Tools -> Customize – Toolbars Tab.



Geodesic Tools



Calculate accurate lengths and areas no matter what projection.
(vector lines and polygons)

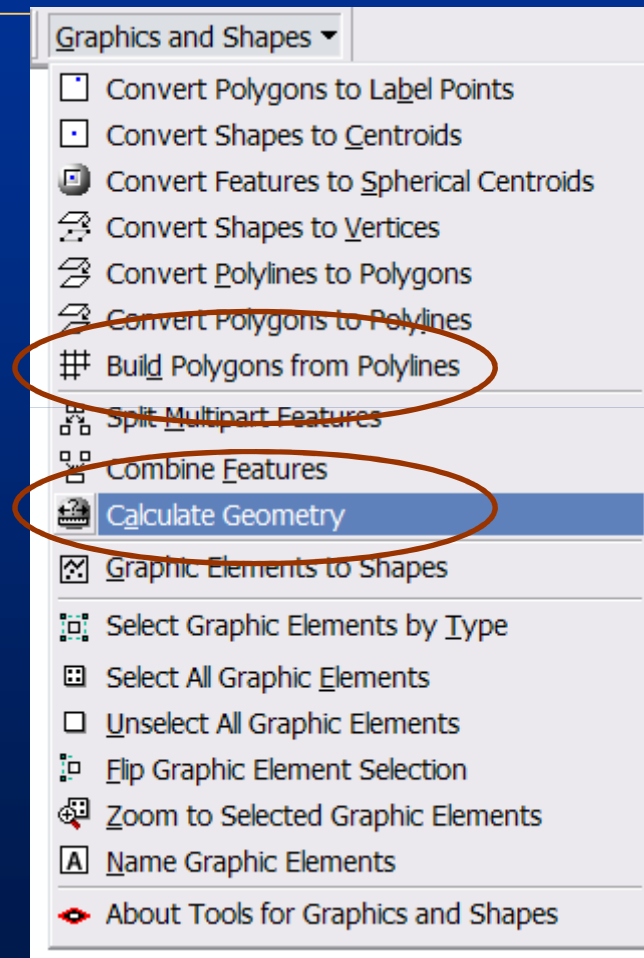


also calculate

- geodesic angles
- geodesic centroids
- convert to/from ocentric <-> ographic
- clip datasets that cross over the bounding meridian (e.g. 180 or 360).

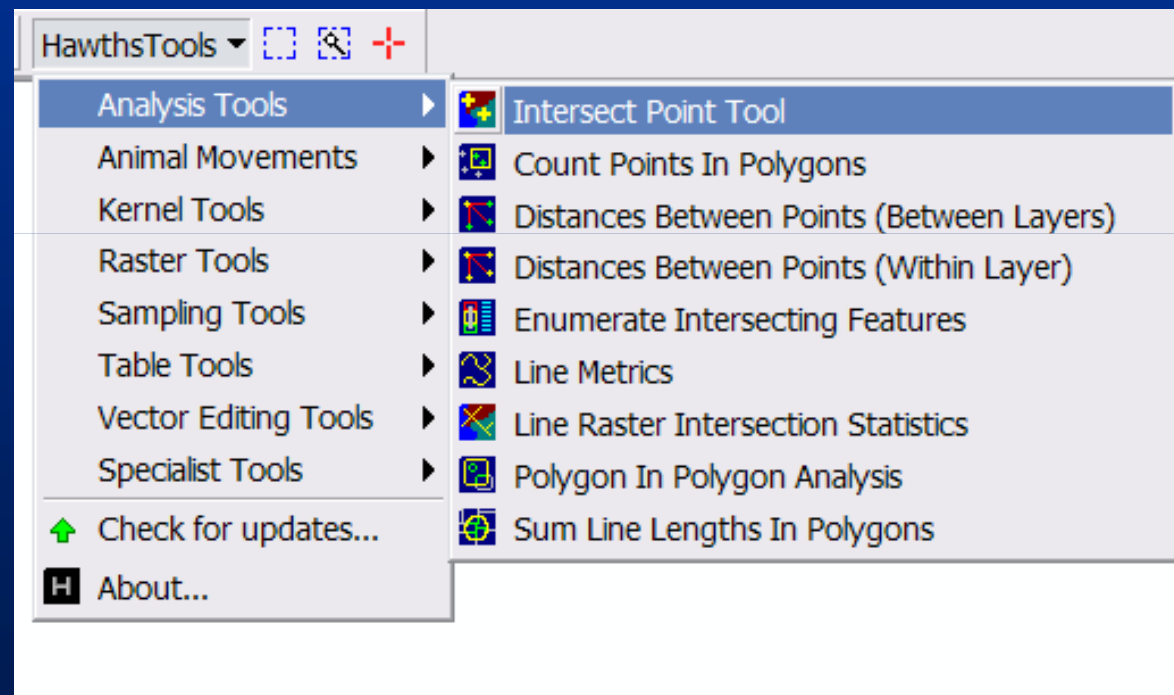
Graphic and Shapes

- Build polygons (show later)
- Eventual house geodesic tools
- Much more...

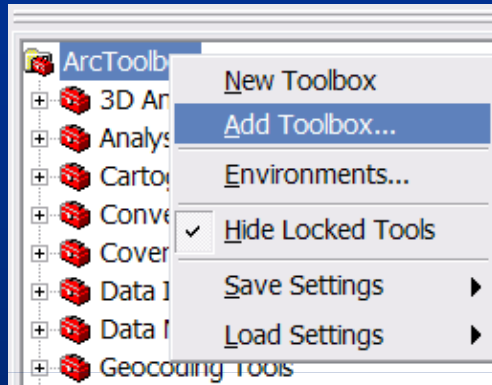


Hawths Tools

- Built for animal corridor tools but many more useful tools

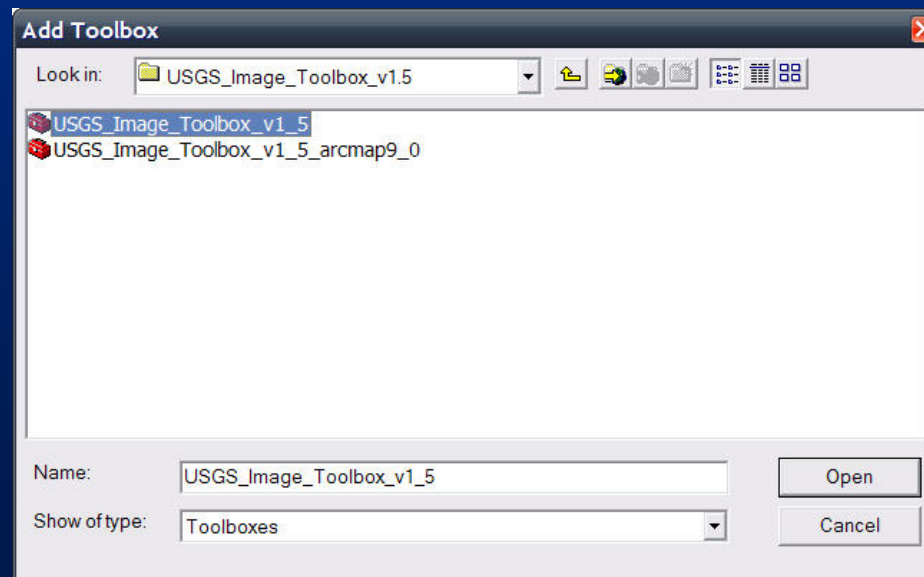


Add Toolbox



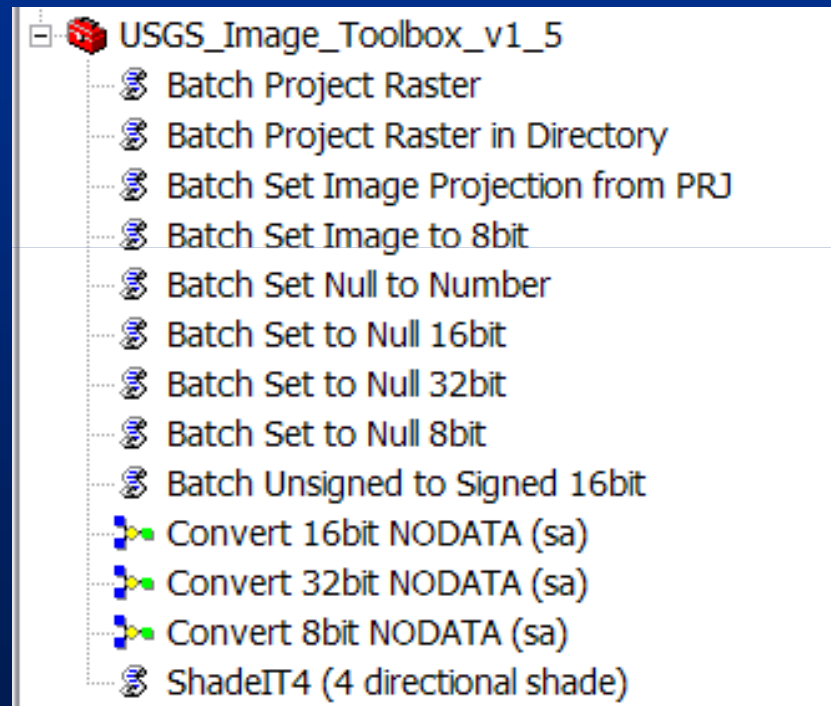
Right click on top
ArcToolbox folder

Browse to file



USGS Image Toolbox 1.5

- Set Null Data Values
- Batch project
- Batch define
- More...



ArcScripts

- Download files from the ESRI website:
(<http://support.esri.com/index.cfm?fa=downloads.gateway>)
- Search ArcScripts for the tool of interest
- Be sure that the tool is built for your version of ArcGIS
- Download the zip file to your computer

Use the Easy Calculate Scripts

- Easy Calculate is a set of expressions (currently 110) for the ArcGIS Field Calculator.
- Calculate some spatial characteristics of the features, edit the shapes, add records to a target layer, draw graphics etc.
- Tip: to calculate geometry field in ArcMap9.3 (select field, type: Ctrl, Shift, F)

http://www.ian-ko.com/free/free_arcgis.htm

Feedback

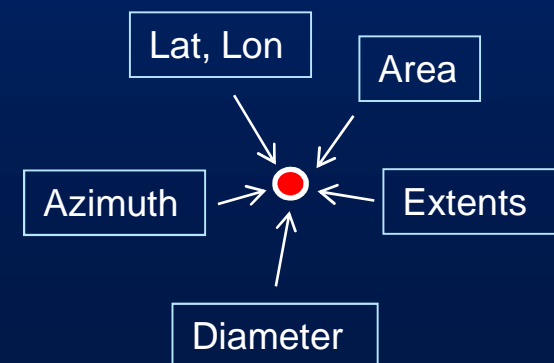
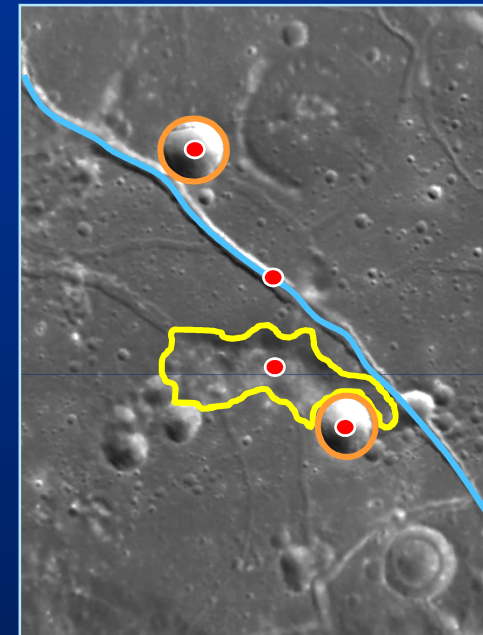
- Future workshops
- What are your current problems
- Modules (on-line only)
- Appropriate use of data (what arc is good at)

Crater Helper Tools (or the Crater/Feature tools) for ArcMap

Richard A Nava

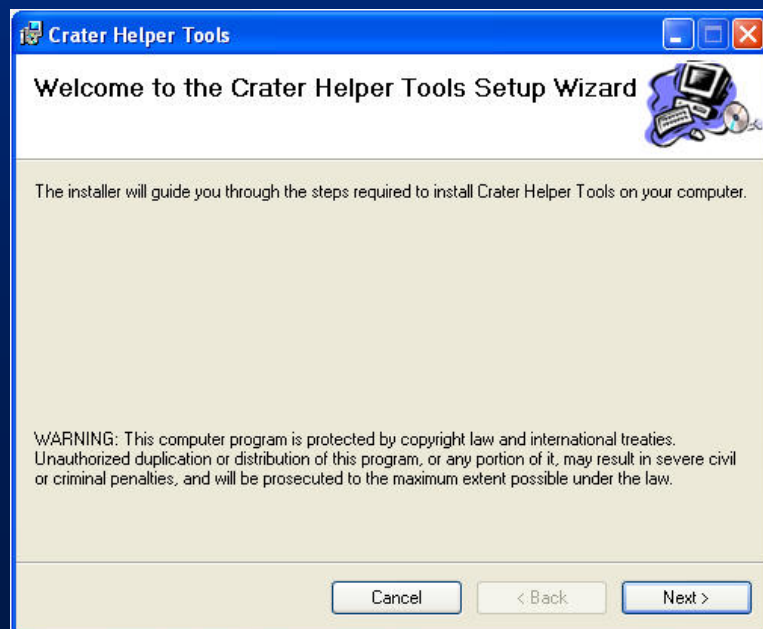
What for?

- Originally for “nomenclature”
- To digitize craters and other features
- Store several attributes about each feature on creation
- Geodesic length and area measurements
- Any projection
- All information is stored in point features
- Show measurements as graphics, or create polylines
- Link polylines to points



Download & Installation

1. Download from “**PIGWAD**” web-page
2. Double-click: “CraterHelperSetup.msi”
3. Follow dialog instructions:

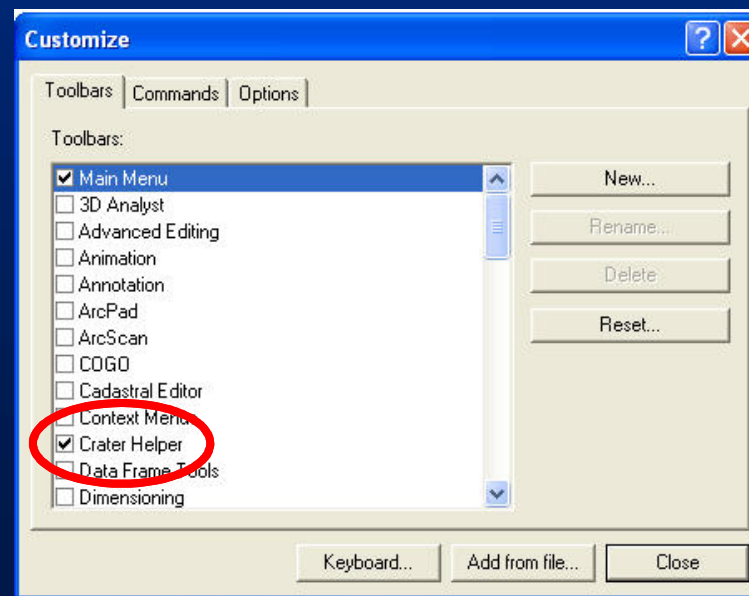


Default installation
location:

C:\Program_Files\USGS_Astro

Crater Helper in ArcMap

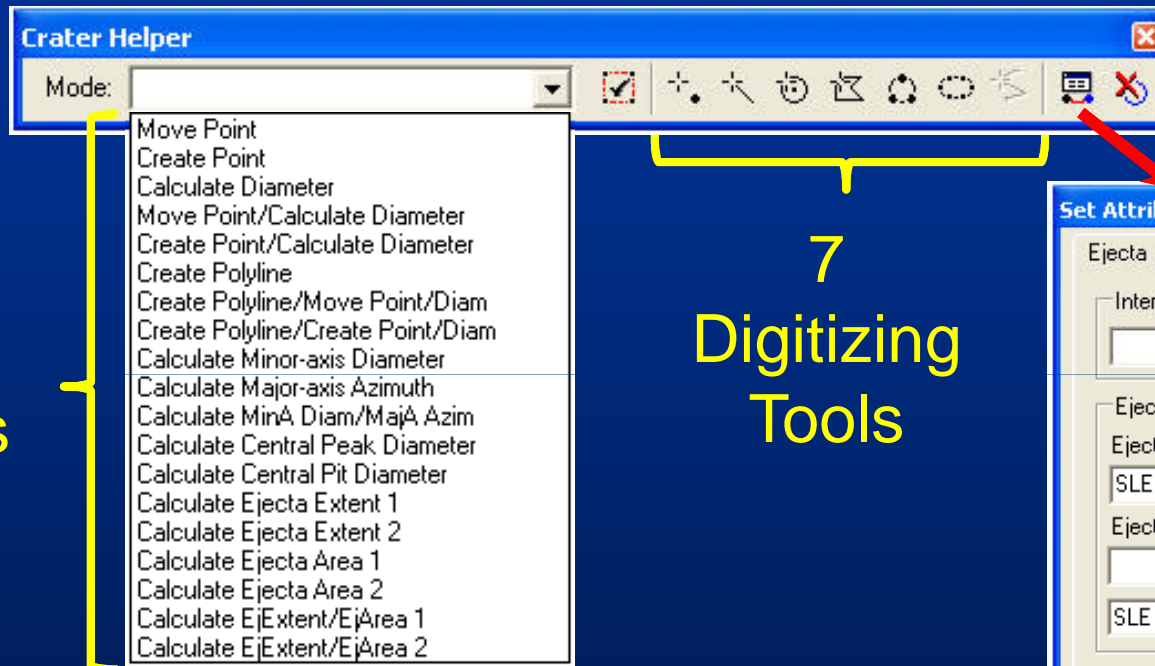
- It is an add-on toolbar
- After install:
 - Tools menu > Customize > Toolbars tab > “Crater Helper” checkbox



Interface

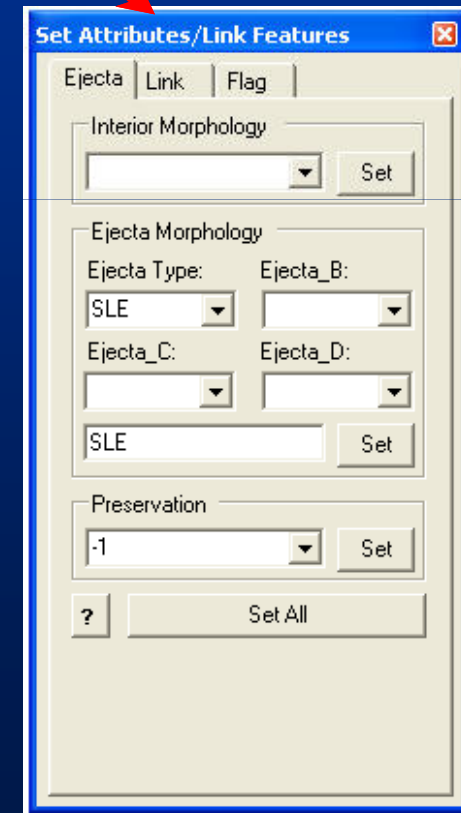
Toolbar

19
Modes



7
Digitizing
Tools

Dockable
Window

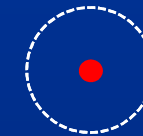


“Modes” (19)

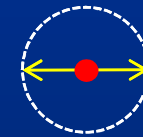


- Move Point
- Create Point
- Calculate Diameter
- Create Polyline
- Calculate Axis Length
- Calculate Axis Azimuth
- Calculate Central Peak Diameter
- Calculate Ejecta Extent
- Calculate Ejecta Area

... and combinations of these



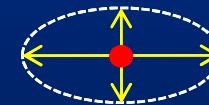
Lat, Lon



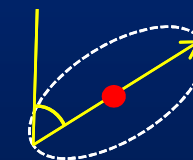
Km



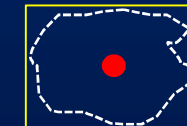
(polyline)



Km



Deg.



X_{\min} , Y_{\max}



Km²

Digitizing tools (7)



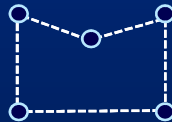
← By Point



← By Line



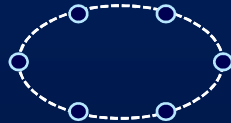
← By Circle



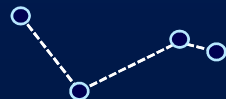
← By Polygon



← By 3-Point Circle



← By 6-Point Ellipse



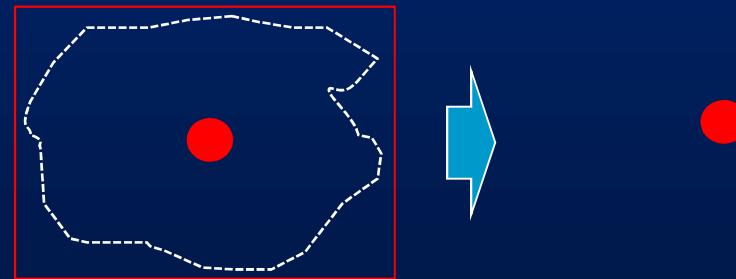
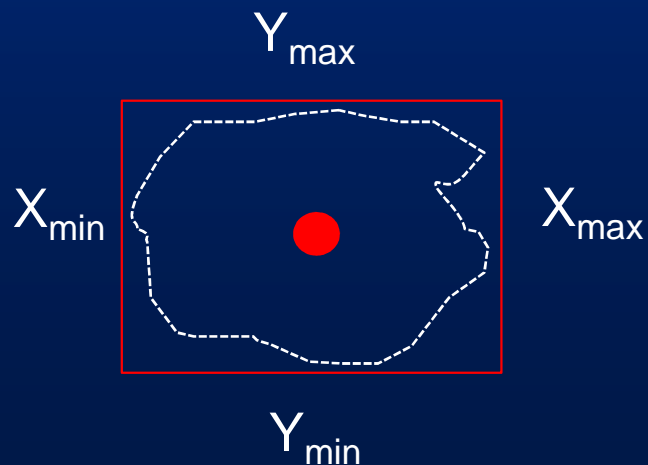
← By Multi-Point Line

Enable Extents & Erase Graphics



Enables extent computations to be stored in the point feature, and graphics to show on the map

Erases all graphics from the map with one click



Creating/Measuring Features

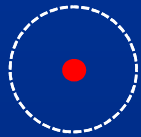
Select a mode



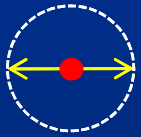
Select a tool



Create/measure
on map



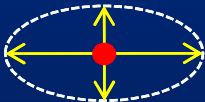
Lat, Lon



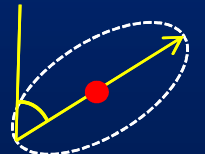
Km



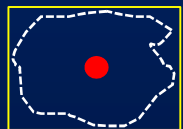
(polyline)



Km



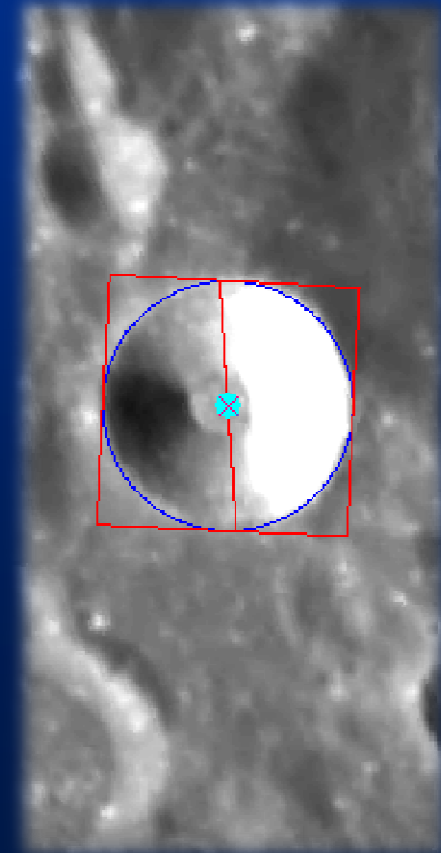
Deg.



X_{\min} , Y_{\max}



Km²



Example 1:

Mode: Create Point/Calculate Diameter

The screenshot displays the 'Crater Helper' software interface. The main window shows a grayscale image of a lunar surface with a crater. A red square box is drawn around the crater, and a blue circle is inscribed within it. A cyan 'x' marks the center of the crater. Yellow arrows point from the 'X_MIN', 'X_MAX', 'Y_MIN', and 'Y_MAX' columns of the table to the corners of the red box. Another yellow arrow points from the 'RIM_DIA' column to the blue circle. A third yellow arrow points from the 'LAT' and 'LOI' columns to the cyan 'x'.

Crater Helper

Mode: Create Point/Calculate Diameter

Selected Attributes of FG_Crater_points

	OBJECTID ^	SHAPE ^	X_MIN	X_MAX	Y_MIN	Y_MAX	RIM_DIA	LAT	LOI	FLAG
	960	Point	-93.147183	-92.552584	55.856427	56.188731	10.076551	56.022579	-92.849882	1

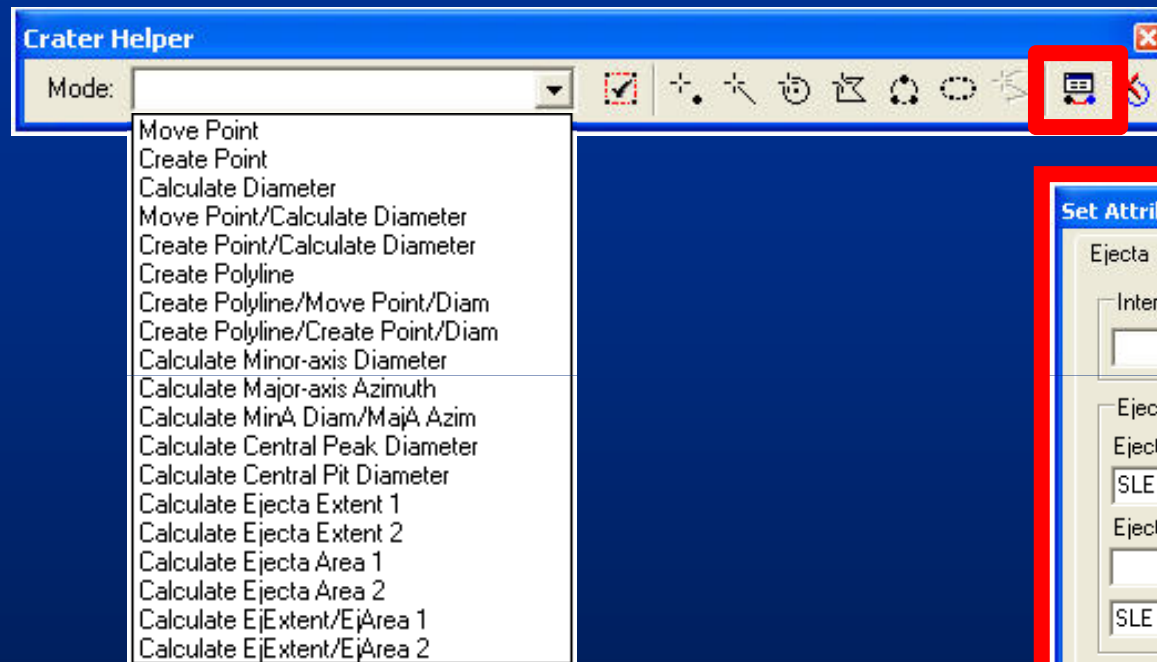
Record: 0 Show: All Selected Records (Options

Extents

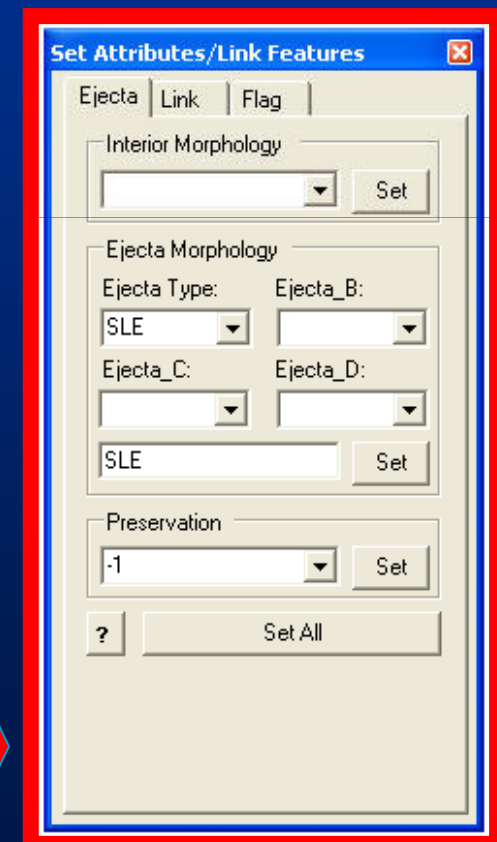
Rim Diameter

Location

Crater Helper Tools



**Dockable
Window**



Set Attributes/Link Features

Ejecta tab

The 'Set Attributes/Link Features' dialog box, Ejecta tab, contains the following sections:

- Interior Morphology:** A dropdown menu set to 'SY' and a 'Set' button.
- Ejecta Morphology:**
 - Ejecta Type:** A dropdown menu set to 'SLE'.
 - Ejecta_B:** A dropdown menu set to 'R'.
 - Ejecta_C:** A dropdown menu set to 'C'.
 - Ejecta_D:** A dropdown menu set to 'Rd'.
 - A text field containing 'SLERCRd' and a 'Set' button.
- Preservation:** A dropdown menu set to '-1' and a 'Set' button.
- A legend at the bottom listing abbreviations: SLE (Single Layer), DLE (Double Layer), MLE (Multi-Layer), Pd (Pedestal), R (Rampant), P (Pancake), C (Circular), S (Sinuous), Rd (Radial).

Set morphology
and preservation
attributes
(Nadine Barlow)

Link tab

The 'Set Attributes/Link Features' dialog box, Link tab, contains the following sections:

- Link Features:** A checked checkbox.
- Target Layer: (Polyline):** A dropdown menu set to 'FG_Crater_lines'.
- Field:** A dropdown menu set to 'CRATERID'.
- Source Layer: (Point):** A dropdown menu set to 'FG_Crater_points'.
- Field:** A dropdown menu set to 'OBJECTID'.
- A 'Link' button with a question mark icon.
- About:** A text box stating: 'Target' and 'Source' layers must be part of an edit session simultaneously. If a desired layer does not appear on the menus, make sure both reside within same data source.

Link feature
polylines to
points

Flag tab

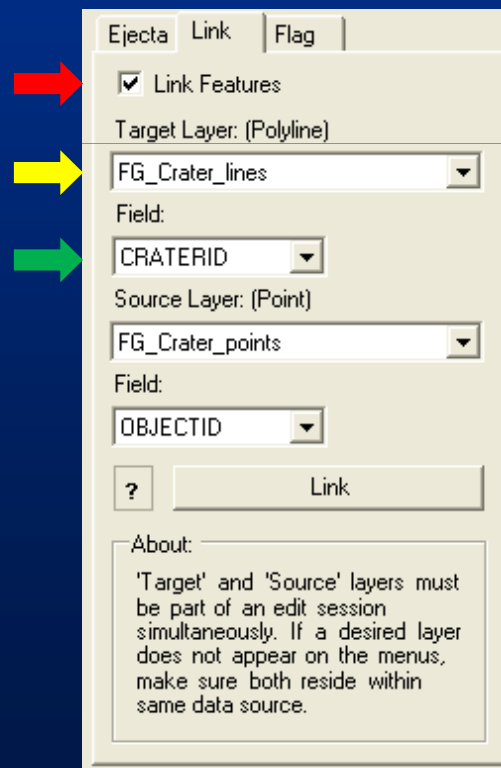
The 'Set Attributes/Link Features' dialog box, Flag tab, contains the following sections:

- Set selection to Complete:** Two buttons labeled 'True' and 'False'.
- An 'Add Flag Field' button.
- About:** A text box stating: 'When editing features, this tab is used to "Flag" the selected features in the layer being edited ("Target" on the Editor toolbar) as True = 1 or False = 0 by assigning these values to the [FLAG] field. If no [FLAG] field is present in the layer being edited, use the "Add Flag Field" button to generate the field. Features edited with the Crater Helper tools are automatically set to True after they have been modified.'

Flag selected
features as
complete or
incomplete

Using the Link tab

1. Check “Link Features”
2. Set Target and Source layers
3. Set Target and Source link fields



The screenshot shows the 'Link' tab of a software interface. It has three tabs at the top: 'Ejecta', 'Link', and 'Flag'. The 'Link' tab is active. Below the tabs, there is a checkbox labeled 'Link Features' which is checked. A red arrow points to this checkbox. Below the checkbox, there are two sections. The first section is for the 'Target Layer: (Polyline)' and has a dropdown menu showing 'FG_Crater_lines'. A yellow arrow points to this dropdown. Below this is a 'Field:' dropdown showing 'CRATERID'. A green arrow points to this dropdown. The second section is for the 'Source Layer: (Point)' and has a dropdown menu showing 'FG_Crater_points'. Below this is a 'Field:' dropdown showing 'OBJECTID'. At the bottom of the tab, there is a button labeled 'Link' and a small icon with a question mark. Below the button is an 'About:' section with text: 'Target and Source layers must be part of an edit session simultaneously. If a desired layer does not appear on the menus, make sure both reside within same data source.'

Dynamic link

Done automatically when creating a polyline and a point after *filling link tab parameters*

Manual link

By selecting a polyline and point and clicking the “Link” button after *filling link tab parameters*

Example 2a:

Link (circle) polyline to point

The screenshot displays the 'Crater Helper' software interface. A red arrow points to the 'Mode' dropdown menu, which is set to 'Create Polyline/Create Point/Diam'. Another red arrow points to a crater on the background image, which is highlighted with a yellow and blue circular outline. The 'Set Attributes/Link Features' dialog box is open, showing the 'Link' tab. The 'Link Features' checkbox is checked. The 'Target Layer' is set to '(Polyline)' and the 'Field' is 'CRATERID'. The 'Source Layer' is set to '(Point)' and the 'Field' is 'OBJECTID'. The 'Link' button is visible. Below the dialog box, the 'About' section provides instructions: 'Target' and 'Source' layers must be part of an edit session simultaneously. If a desired layer does not appear on the menus, make sure both reside within same data source.

Points

OBJECTID *	SHAPE *	X_MIN	X_MAX	Y_MI
960	Point	<Null>	<Null>	<Null>

Lines

SHAPE *	SHAPE_Length	CRATERID *	FLAG
Polyline	2.288078	960	1

Example 2b:

Unclosed polyline (ridge feature)

CraterHelper_Testing.mxd - ArcMap - ArcInfo

File Edit View Bookmarks Insert Selection Tools Window Help

Editor Task: Create New Feature Target: FG_Crater_points

Layers

- PolarN
 - FG_Crater_points
 - FG_Crater_lines
 - basemap

Display Source Selection

Ejecta Link Flag

☒ Link Features

Target Layer: (Polyline)

FG_Crater_lines

Field: CRATERID

Source Layer: (Point)

FG_Crater_points

Field: OBJECTID

Link

Crater Helper

Mode: Create Polyline/Create Point/Diam

Selected Attributes of FG_Crater_points

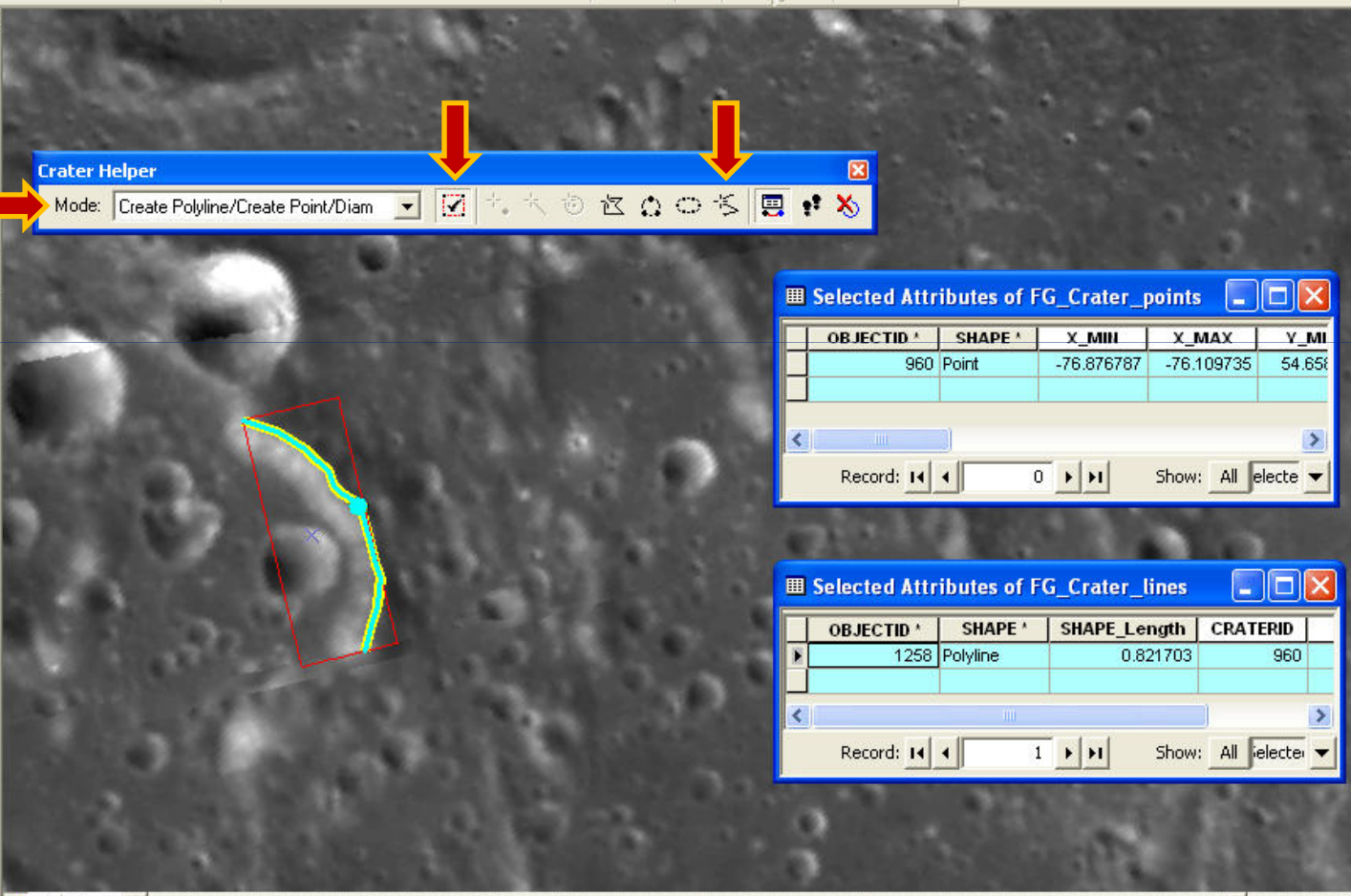
OBJECTID	SHAPE	X_MIN	X_MAX	Y_MIN
960	Point	-76.876787	-76.109735	54.658

Record: 0 Show: All selecte

Selected Attributes of FG_Crater_lines

OBJECTID	SHAPE	SHAPE_Length	CRATERID
1258	Polyline	0.821703	960

Record: 1 Show: All selecte



'Crater Helper Tools' Remarks



- Edit session always required
- The 'Enable Extent Computations' button can be used with most tools and works as a checkbox
- Cannot use all tools with all modes
 - Ex: Cannot create a polyline with the single point tool (some are disabled at times)
- Information is always stored in fields

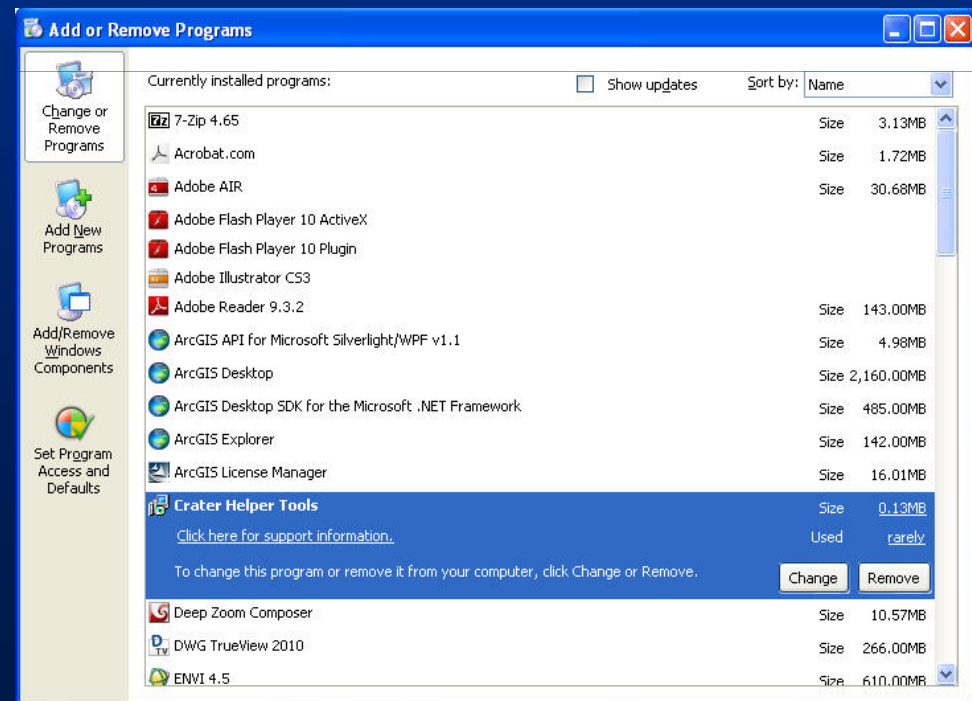
Because of this, the user is prompted about adding several fields when selecting different tools/modes

Feedback

- If it's not that good or you find a problem, please send us feedback, OR.... you can always **uninstall** it 😊...

Uninstalling: Crater Helper

1. Open the Windows 'Control Panel'
2. Double-click 'Add/Remove Programs'
3. Find 'Crater Helper Tools'
4. Click 'Remove'
5. Follow instructions



DEMO

Tools for Crater Statistics

Crater Counting Tools

- New methods for counting craters in ArcGIS
- New software for graphing statistics
- Demo the new software

CraterTools

- CraterTools is a GIS add-on toolbar
 - Download: <http://hrscview.fu-berlin.de/software.html>
 - Publication: Kneissl T., van Gasselt S., Neukum G., Map-projection-independent crater size-frequency determination in GIS environments - New software tool for ArcGIS, Planetary and Space Science, 2010.

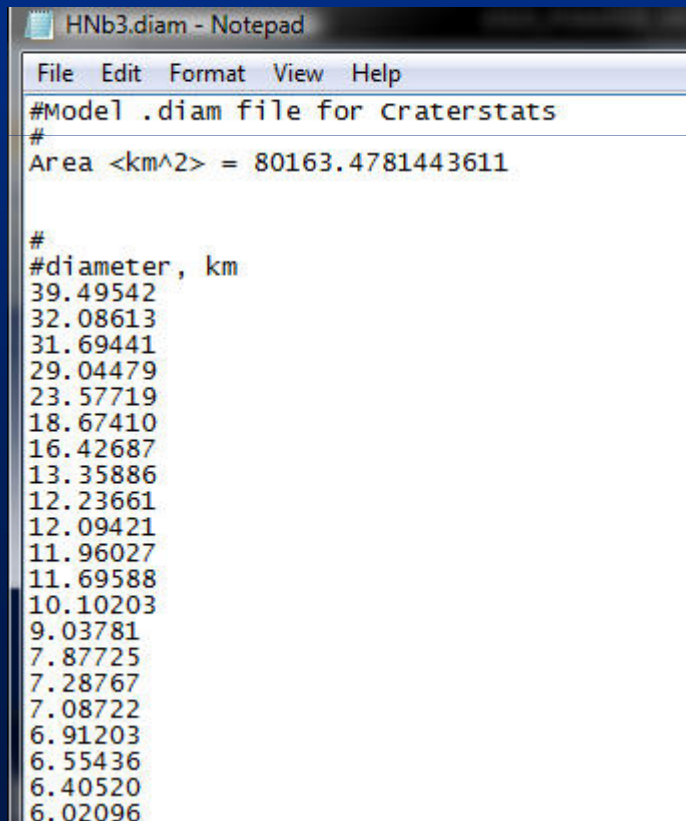
CraterTools Interface



- Green Flag: Create a point and polygon layer
- Grid: Create a grid of a certain size within an area
- Diameter Circle: Create a circle using 2 points
- 3-point Circle: Create a circle using 3 points
- Flag Crater: Mark craters that are of interest
- Scale Tool: Determine if a crater meets the minimum size
- Select/Unselect Areas: Exclude/include areas
- Preview Graph: Allows preview of plotted data
- Checkered Flag: Export data into CraterStats format
- Diameters to Centroid: Converts polygons to points

CraterTools

- Resulting count is output as a text file that includes the crater diameters and the area in km². This file is formatted for CraterStats



```
HNb3.diam - Notepad
File Edit Format View Help
#Model .diam file for craterstats
#
Area <km^2> = 80163.4781443611
#
#diameter, km
39.49542
32.08613
31.69441
29.04479
23.57719
18.67410
16.42687
13.35886
12.23661
12.09421
11.96027
11.69588
10.10203
9.03781
7.87725
7.28767
7.08722
6.91203
6.55436
6.40520
6.02096
```

If you have already finished your crater counts and want to plot them using CraterStats, just add the area and diameters into this format.

DOES NOT matter if the craters are organized into any particular order or bins because CraterStats is smart enough to organize and bin your data

CraterStats

- Produces uniform plots of crater statistic and fit isochrons to deposition and resurfacing
 - Download: <http://hrscview.fu-berlin.de/software.html>
 - Also need to download the IDL virtual machine – also at the location above
 - Publication: Michael G.G., Neukum G., *Planetary surface dating from crater size-frequency distribution measurements: Partial resurfacing events and statistical age uncertainty*, Earth and Planetary Science Letters, 2010, DOI: 10.1016/j.epsl.2009.12.041

CraterStats Interface

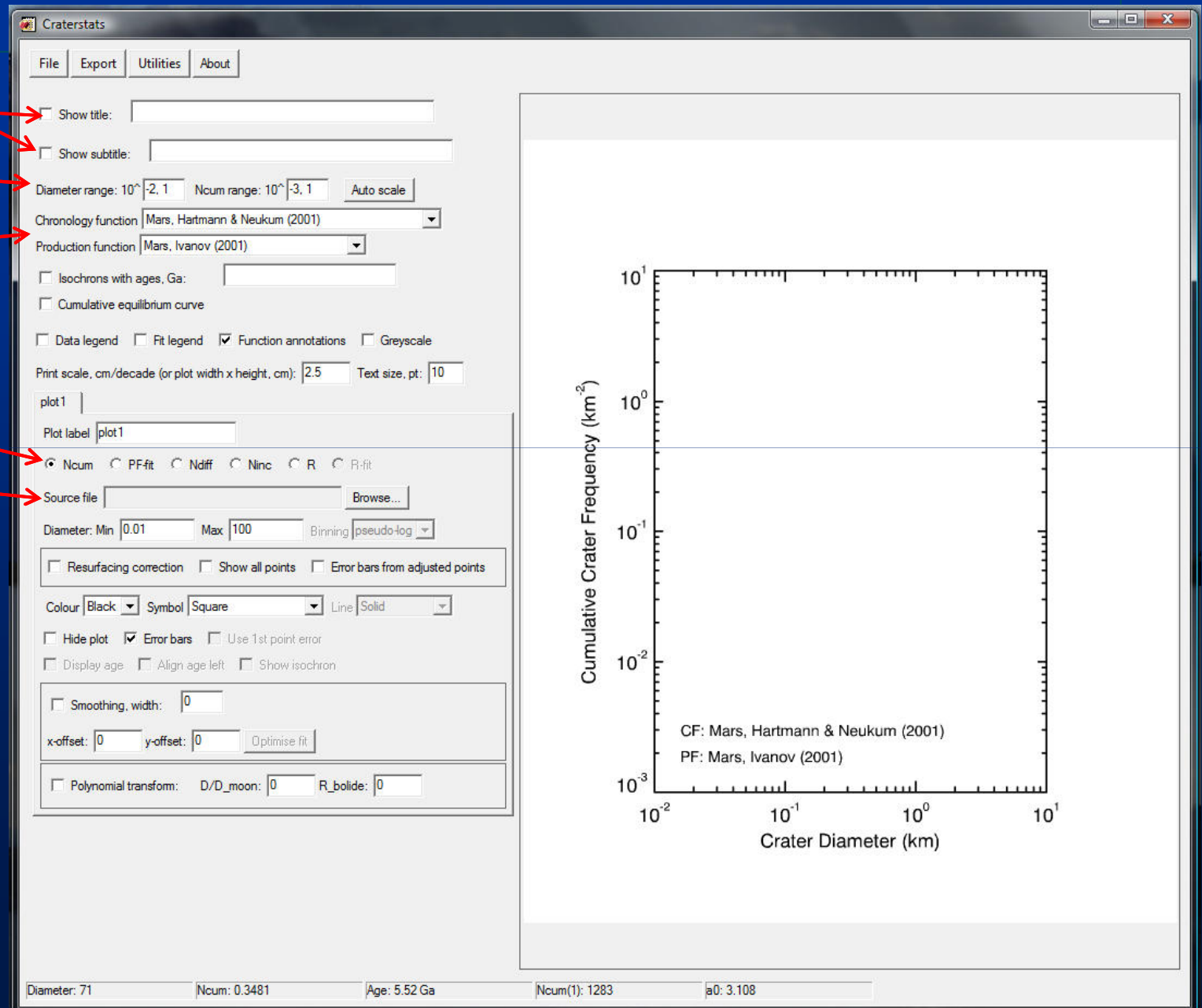
Add Titles

Scale Plot

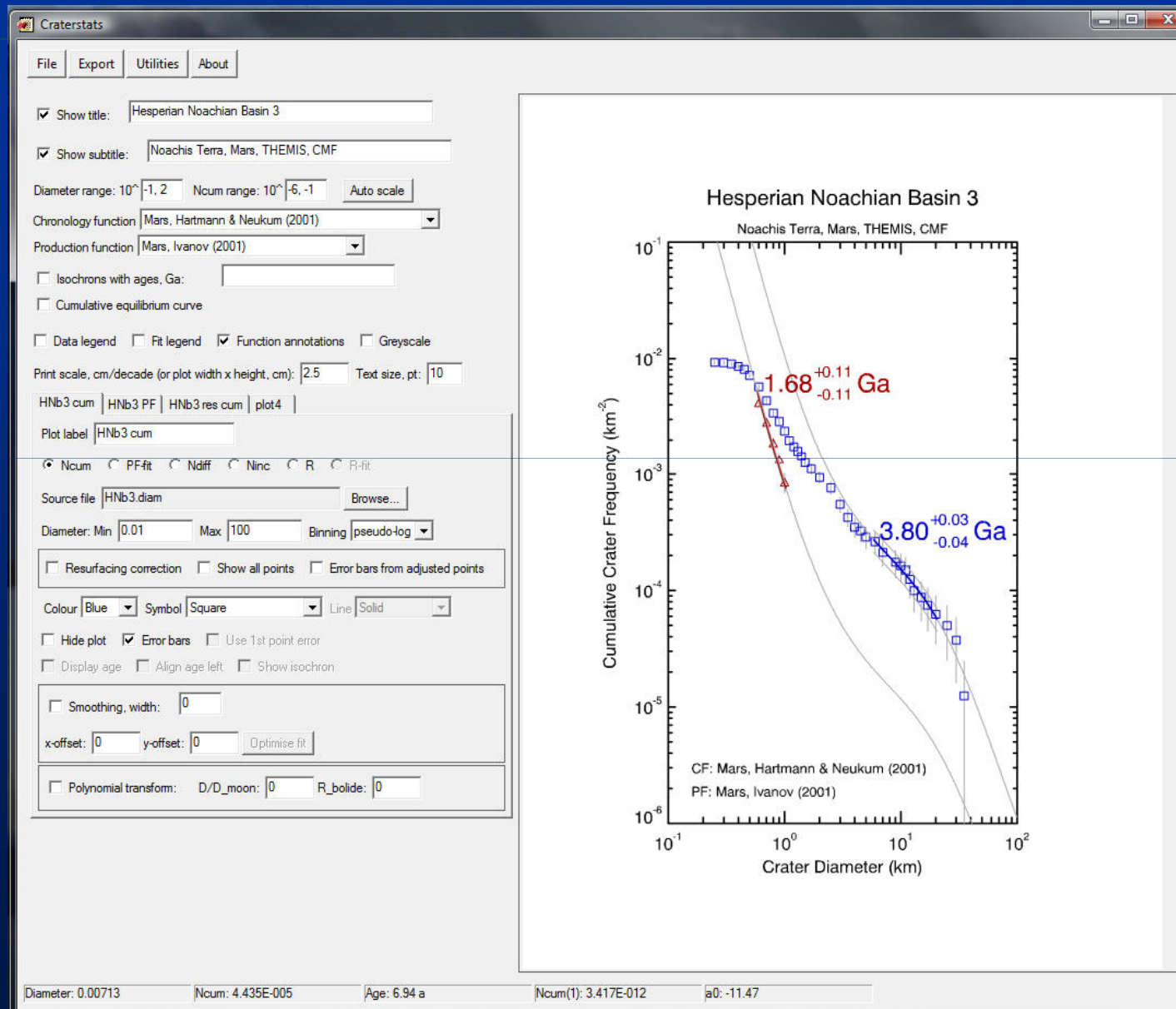
Functions

Plot Types

Insert Text File



CraterStats Interface



CraterStats

- Demonstration

Break Time

Annotation & Nomenclature

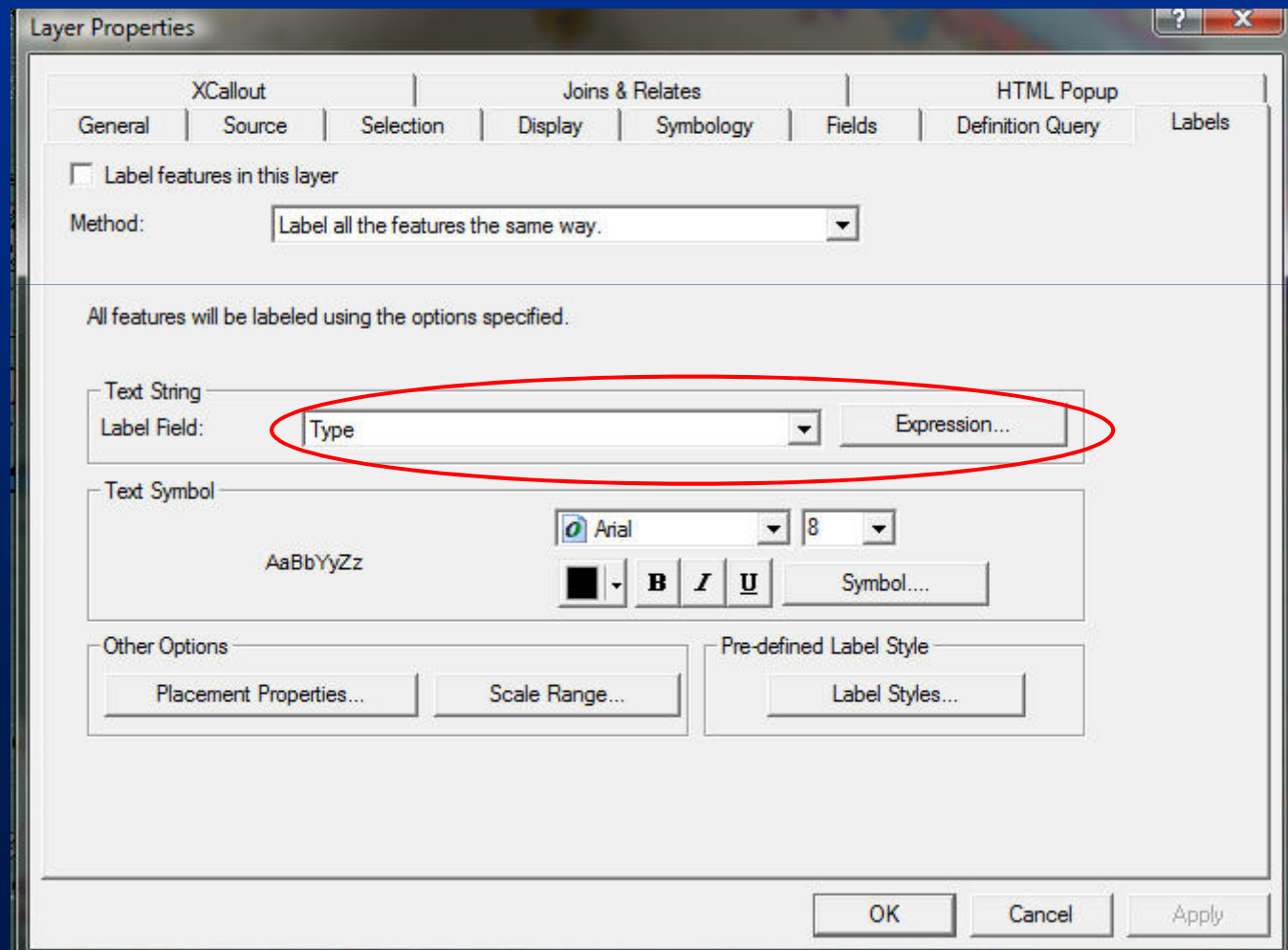
Annotation

- Annotation is ArcGIS's way to store text
 - Vector properties
 - Font types
 - Text strings with HTML code, i.e. subscript
 - Leaders
- Annotation can be stored as a feature class and be synced to the feature class that it is associated with, e.g. Geology and the Geology_Annotation feature classes
- Annotation will update based on changes to the original feature class

Steps To Add Annotation

- Annotation starts from the labels generated in the Layer Properties of the original feature class

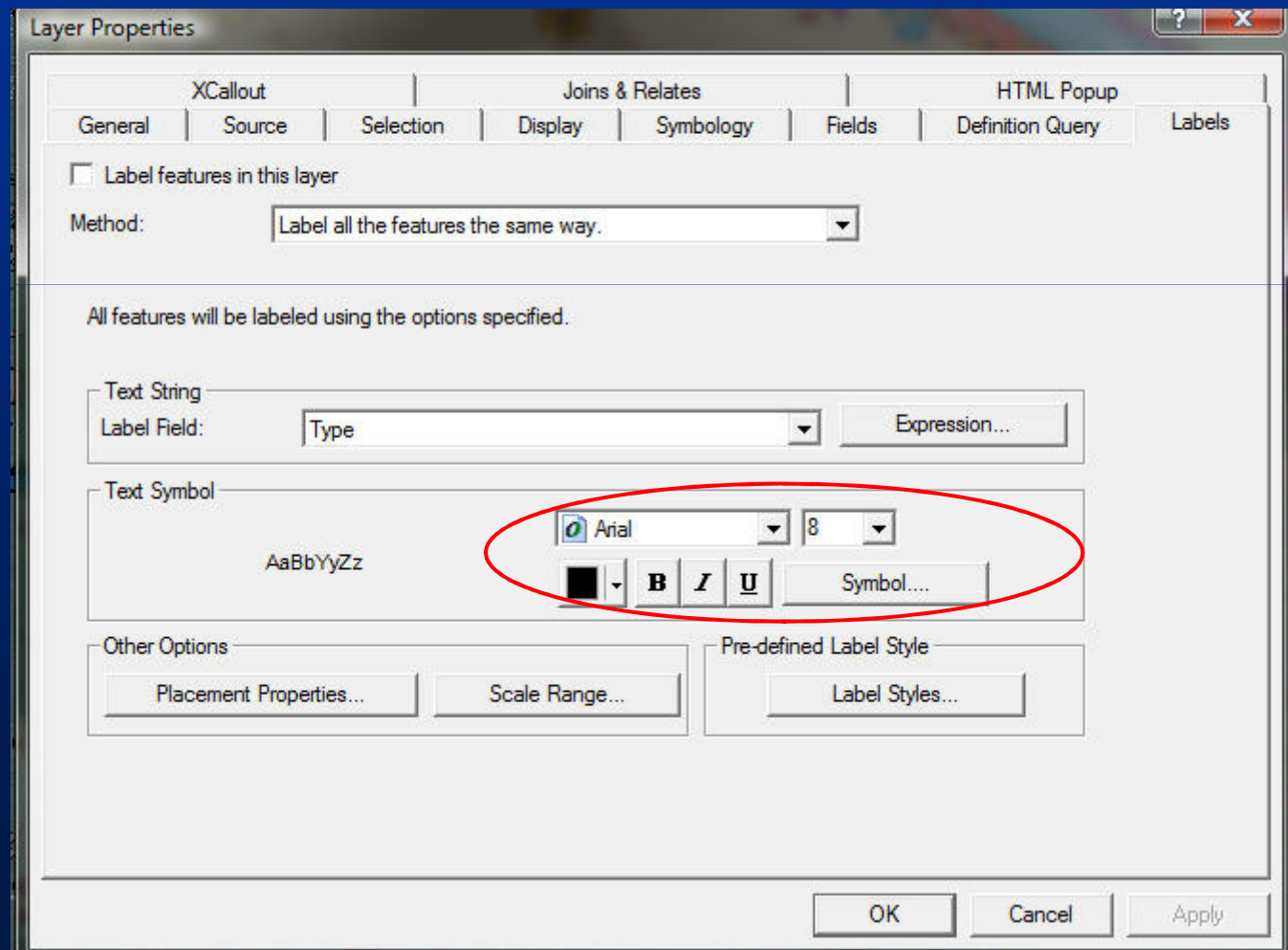
You can use a field in the table or you can customize using an expression



Steps To Add Annotation 1

- Annotation starts from the labels generated in the Layer Properties of the original feature class

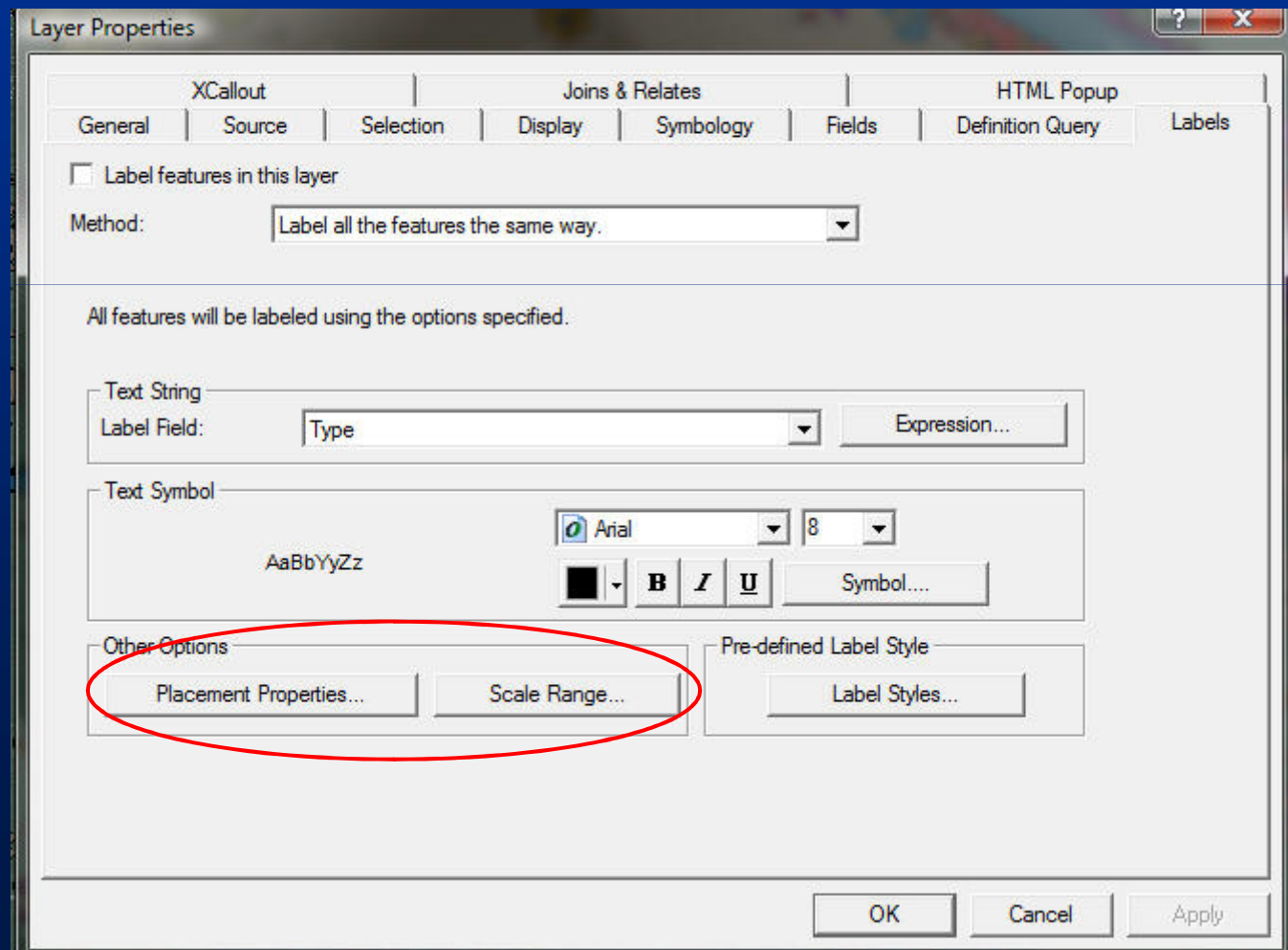
You can adjust the font, size, or use a predefined symbol



Steps To Add Annotation 1

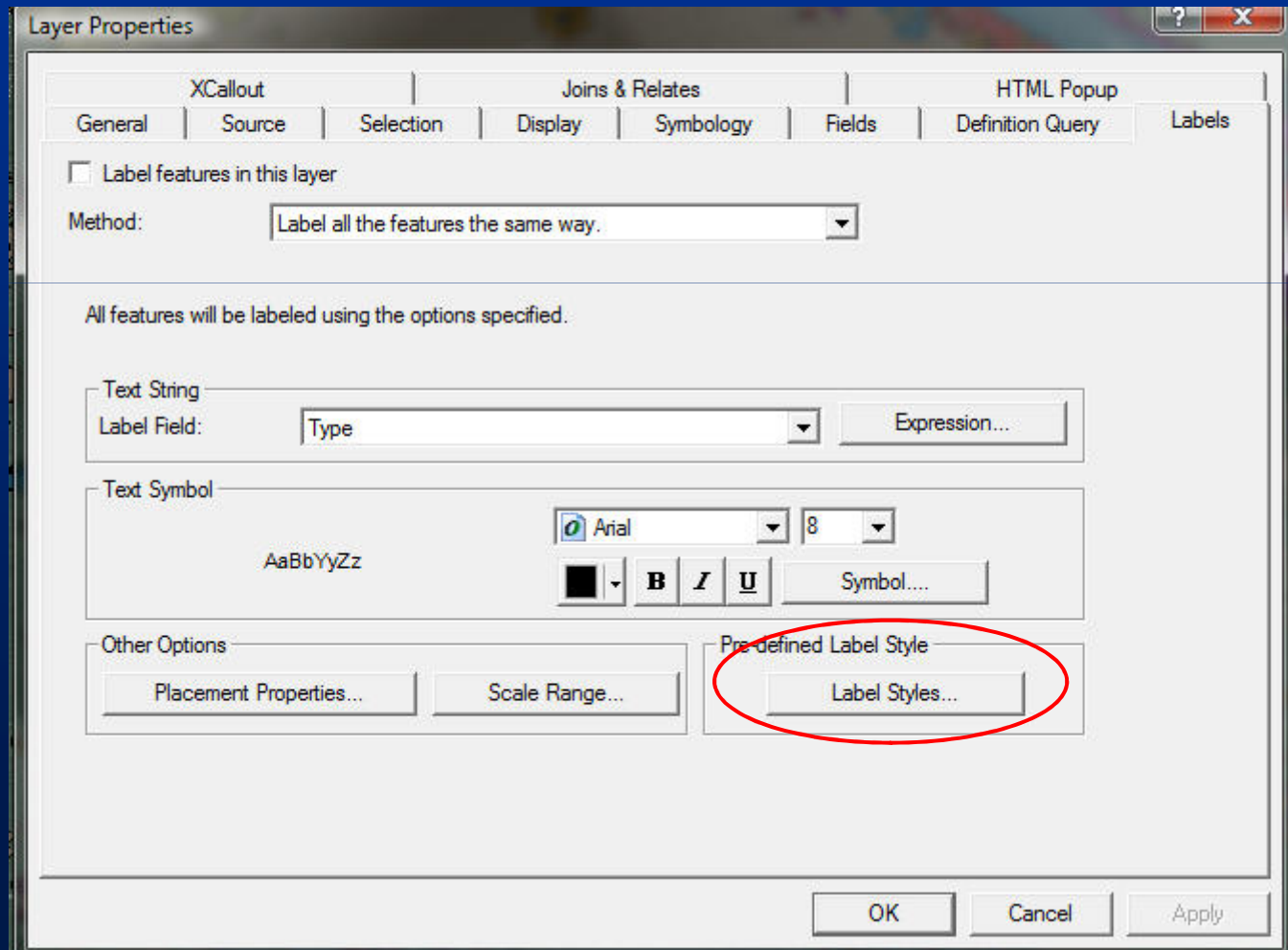
- Annotation starts from the labels generated in the Layer Properties of the original feature class

You can adjust how your labels draw & at what scales the labels are visible



Steps To Add Annotation 1

- Annotation starts from the labels generated in the Layer Properties of the original feature class

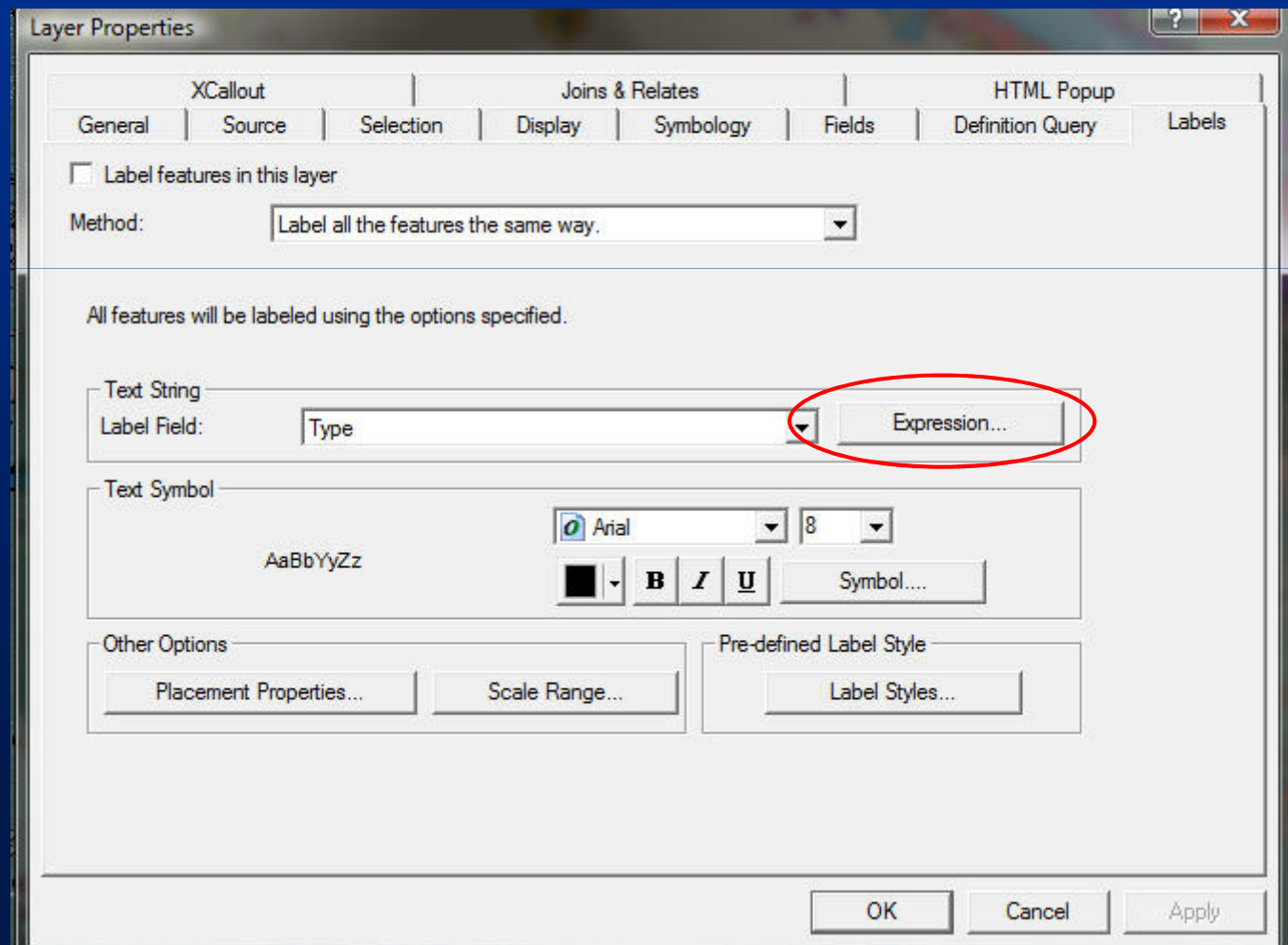


You can use the ESRI label styles, mostly topo or road map styles

Steps To Add Annotation 1

- Annotation starts from the labels generated in the Layer Properties of the original feature class

Custom expressions are the best way to get exactly what you want out of your anno



Steps To Add Annotation 2

- Set up your table to reflect what you want out of the labels

Type = Full unit names

Symbol = Full unit symbol

Age = Age Symbol

Province = Province Symbol

Unit = Unit Symbol

Subscript = Subscript characters

Use separate fields for portions of the symbols if there will be differences in how you want them to be represented

ABvi (no need to separate fields)

ABv_i (put into separate fields)

Shape *	Type	Symbol	Age	Province	Unit	Subscript
Polygon	Rupes Tenuis	ABrt	H	B	b	r
Polygon	Rupes Tenuis	ABrt	H	B	b	r
Polygon	Rupes Tenuis	ABrt	H	B	b	r
Polygon	Rupes Tenuis	ABrt	H	B	b	r
Polygon	Rupes Tenuis	ABrt	H	B	b	r
Polygon	Rupes Tenuis (Queried)	ABrt	H	B	b	r
Polygon	Rupes Tenuis (Queried)	ABrt	H	B	b	r
Polygon	Rupes Tenuis	ABrt	H	B	b	r
Polygon	Rupes Tenuis	ABrt	H	B	b	r
Polygon	Rupes Tenuis	ABrt	H	B	b	r
Polygon	Scandia	ABs	AH	B	s	<Null>
Polygon	Scandia	ABs	AH	B	s	<Null>
Polygon	Scandia	ABs	AH	B	s	<Null>
Polygon	Scandia	ABs	AH	B	s	<Null>
Polygon	Scandia	ABs	AH	B	s	<Null>
Polygon	Scandia	ABs	AH	B	s	<Null>
Polygon	Scandia	ABs	AH	B	s	<Null>
Polygon	Scandia	ABs	AH	B	s	<Null>
Polygon	Scandia	ABs	AH	B	s	<Null>
Polygon	Scandia	ABs	AH	B	s	<Null>
Polygon	Scandia	ABs	AH	B	s	<Null>
Polygon	Scandia	ABs	AH	B	s	<Null>
Polygon	Scandia	ABs	AH	B	s	<Null>
Polygon	Scandia	ABs	AH	B	s	<Null>
Polygon	Scandia	ABs	AH	B	s	<Null>
Polygon	Scandia	ABs	AH	B	s	<Null>
Polygon	Scandia	ABs	AH	B	s	<Null>
Polygon	Scandia	ABs	AH	B	s	<Null>
Polygon	Vastitas Borealis interior	ABvi	AH	B	v	i
Polygon	Vastitas Borealis interior	ABvi	AH	B	v	i
Polygon	Vastitas Borealis interior	ABvi	AH	B	v	i
Polygon	Vastitas Borealis interior	ABvi	AH	B	v	i
Polygon	Vastitas Borealis interior	ABvi	AH	B	v	i

Record: 0 Show: All Selected Records (0 out of 612 Selected)

Steps To Add Annotation 3

- Write the proper expression to customize your annotation
- Expression components can be found at http://webhelp.esri.com/arcgisdesktop/9.3/index.cfm?TopicName=About_building_label_expressions

- For the table on the previous slide:

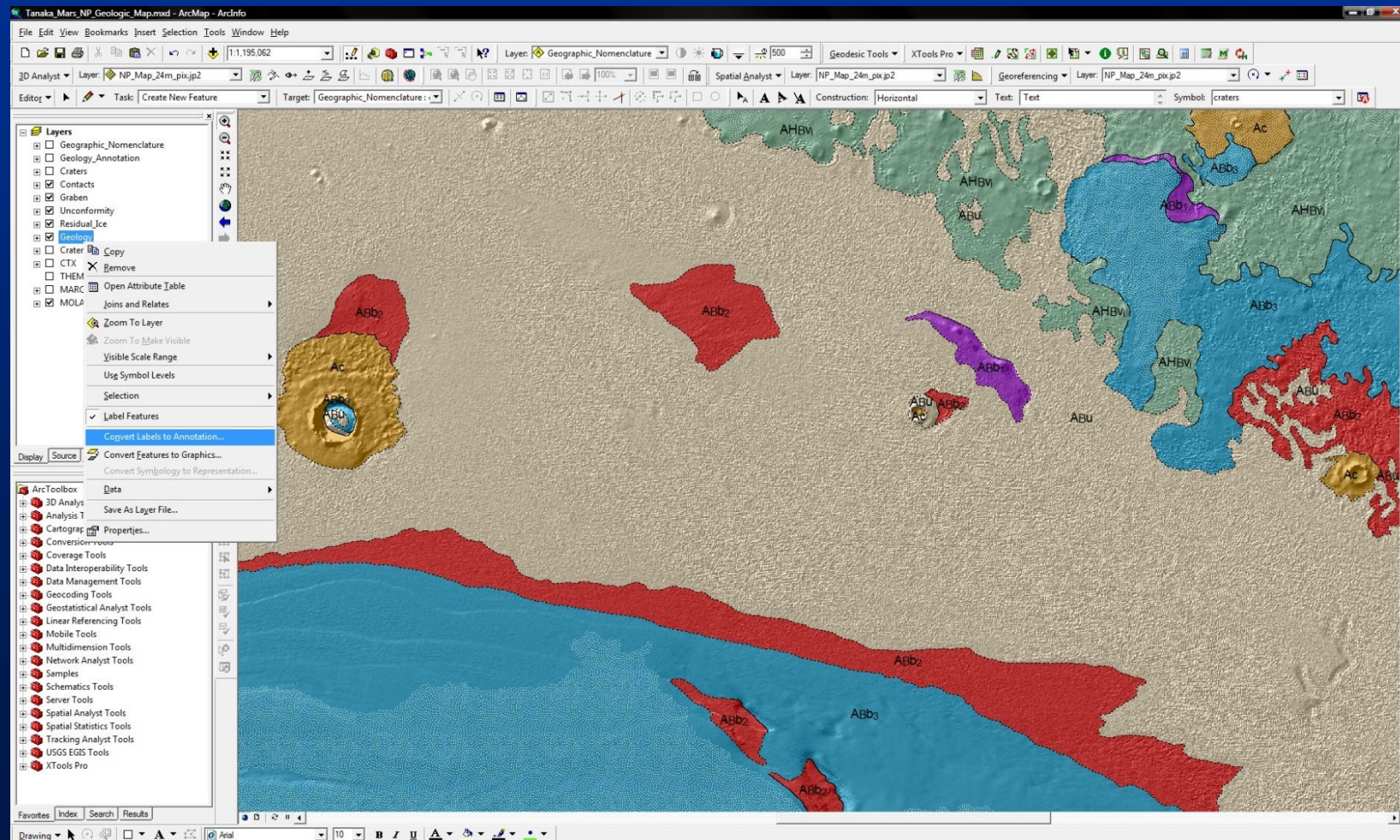
```
"<FNT name='Arial' size='8'>" & [Age] & "</FNT>" & "<FNT name='Arial' size='7'>" & [Province] & "</FNT>" & "<FNT name='Arial' size='8'>" & [Unit] & "</FNT>" & "<FNT name='Arial' size='7'><SUB>" & [Subscript] & "</SUB></FNT>"
```

OUTPUT: ABV_i

Visually inspect your map and your labels to make sure their “look” is correct. Don’t worry about placement within the polygon, you will fix that after converting to annotation. If some polygons don’t have a label, you can go back to placement properties and “Draw overlapping labels” or wait until you convert to annotation because you can copy and paste extra labels

Steps To Add Annotation 4

- Change labels to an annotation feature class associated with the vector feature class



Steps To Add Annotation 4

- Change labels to annotation feature class associated with the vector feature class

Store annotation: Always choose “In a database” NOT the map

If the Reference Scale is not specified, cancel this dialog box and go to the Table of Contents, right click on Properties and set the reference scale to the scale of your print map

Create Annotation: Choose “All features”

Feature Layer	Feature Linked	Append	Annotation Feature Class
Geology	<input checked="" type="checkbox"/>	<input type="checkbox"/>	GeologyAnno

Destination: Tanaka_Mars_NP_Geologic_Map.gdb\NP_Geomap_2009\GeologyAnno

☒ Convert unplaced labels to unplaced annotation

Convert Cancel

Steps To Add Annotation 4

- Change labels to annotation feature class associated with the vector feature class

Make sure the Feature Layer is correct

Check Feature Linked

You shouldn't have to worry about append, if it is checked, remove the check

Annotation Feature Class shows the name of the new class

Check the Destination

Feature Layer	Feature Linked	Append	Annotation Feature Class
Geology	<input checked="" type="checkbox"/>	<input type="checkbox"/>	GeologyAnno

Destination: Tanaka_Mars_NP_Geologic_Map.gdb\NP_Geomap_2009\GeologyAnno

☒ Convert unplaced labels to unplaced annotation

Convert Cancel

Steps To Add Annotation 4

- Change labels to annotation feature class associated with the vector feature class

If there is a check in “Convert unplaced labels to unplaced annotation”, you can go back into the Label tab in the Feature properties and adjust the Placement Properties.

OR

Not worry about it because we can copy and paste annotation

Click on Convert

Feature Layer	Feature Linked	Append	Annotation Feature Class
Geology	<input checked="" type="checkbox"/>	<input type="checkbox"/>	GeologyAnno

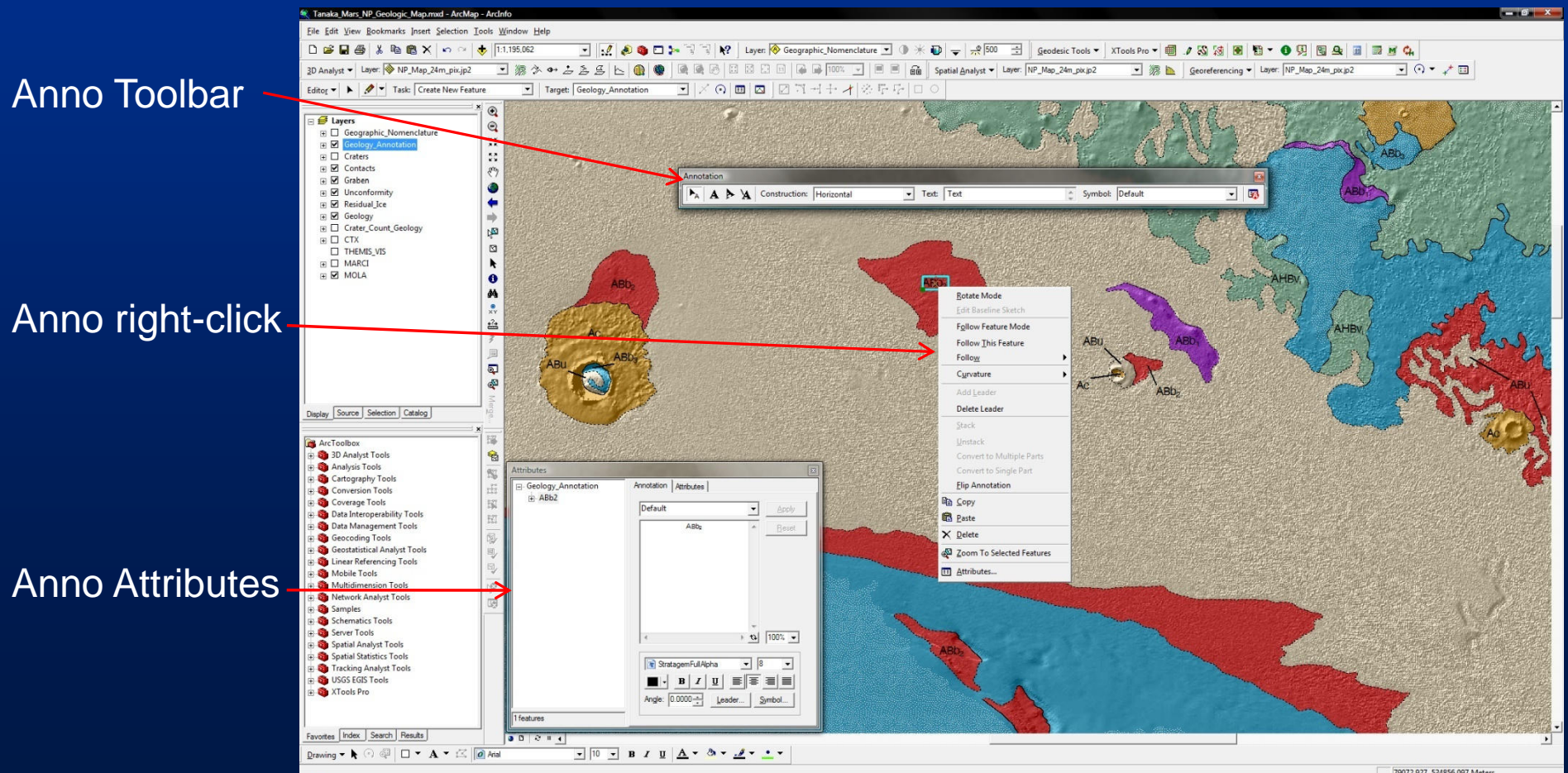
Destination: Tanaka_Mars_NP_Geologic_Map.gdb\NP_Geomap_2009\GeologyAnno

☒ Convert unplaced labels to unplaced annotation

Convert Cancel

Manipulating Annotation

- Change location, add leader/multiple leaders, change the appearance using the Annotation Toolbar and/or Annotation Attributes.



Manipulating Annotation

- Things I typically do:
 - Select all, add a “Simple Line Callout” (Leader) using a 1.00 thick black line to every piece of anno using the Annotation Attributes menu
 - Zoom into a corner of the map and start to move anno to clear locations, and systematically pan through the map
 - Add multiple leaders in locations where the units are too dense for clear placement of multiple unit symbols

Manipulating Annotation

- Select all, add a “Simple Line Callout” using a 1.00 thick black line to every piece of anno using the Annotation Attributes menu
- Why: Depending on the density of units in your map, there is a potential need for a lot of leaders. Faster to delete them from anno that doesn't need them.
- How:
 1. Right click on the annotation feature class in the Table of Contents, choose 'Selection', Choose 'Select All'
 2. Start editing
 3. Using the Annotation toolbar, use the 'Edit Annotation Tool' (black arrow with an uppercase 'A'), right click on any selected anno, choose 'Attributes' (very bottom)
 4. In the left pane of the new window click on the top word in the box (HINT: it will be the name of the annotation feature class). Make sure it is highlighted
 5. Click on Leader in the bottom right of the Attributes window, a new window will appear
 6. Click on the Type dropdown menu in the right side Properties pane and choose 'Simple Line Callout'
 7. Click the 'Symbol' button and change the color to black
 8. Click 'OK', Click 'OK', Click 'Apply'

Manipulating Annotation

- Alternatively

- If you don't think you will need a lot of leaders then you can add leaders manually:

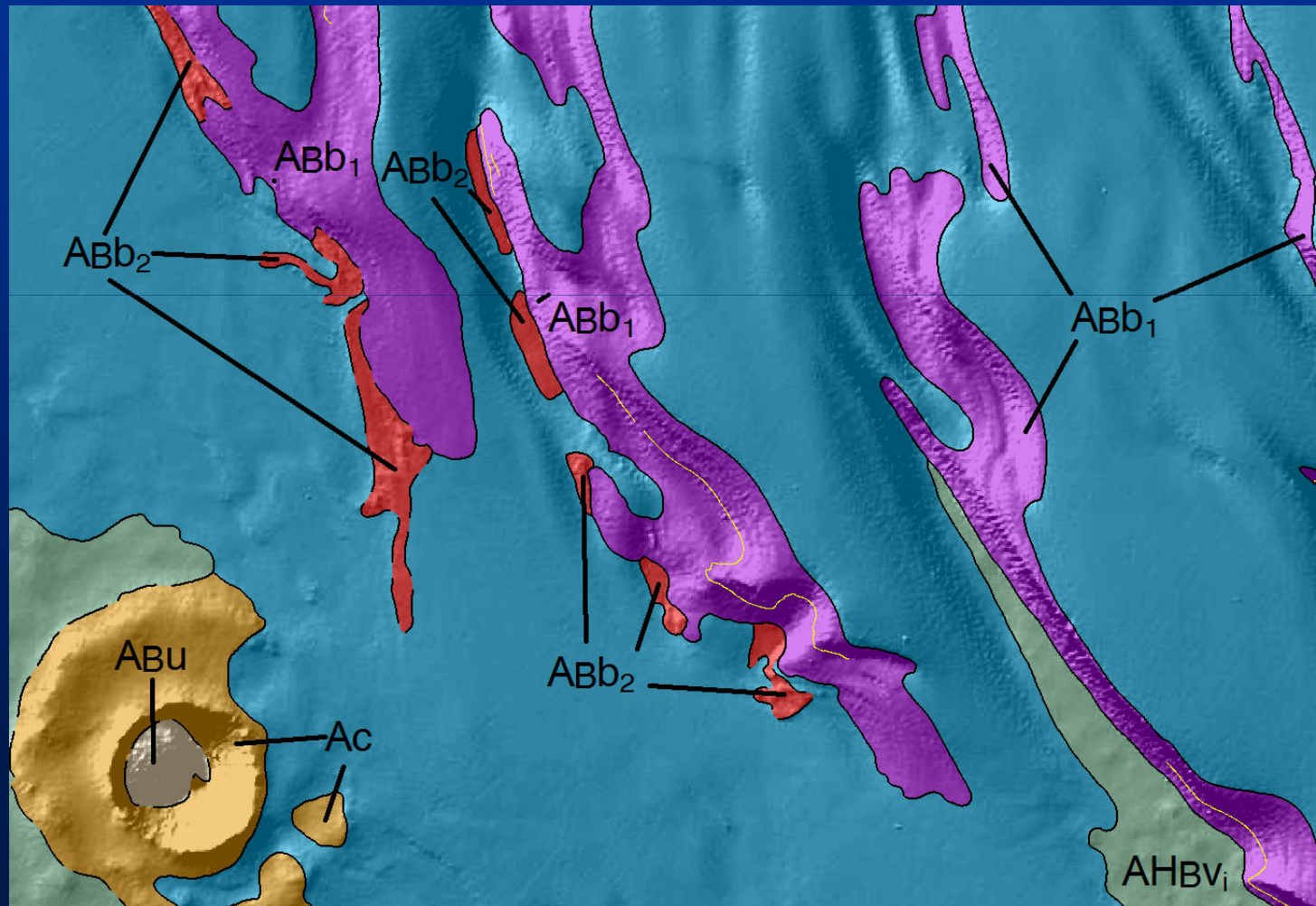
- Select the anno
 - Right click using the Edit Annotation Tool
 - Choose 'Add Leader'
 - Follow steps 5 – 8 from the slide above to customize the look of the leader

Manipulating Annotation

- Zoom into a corner of the map and start to move anno to locations where they are clear, and systematically pan through the map to make sure all anno is placed and that all features are annotated. Turn on all of the features and other layers of annotation to detect conflicts
- The labeling rules from FGDC Carto Standards (pp.27-29)
 - “For a map to be easily read, labels and leaders should be placed where they are clear and legible, taking care to avoid overprinting of linework, symbols, or other labels” –FGDC (2006)
 - All feature labels should be horizontal
 - Leaders are straight lines, should cross the contact at as high an angle as possible, should extend into the unit, should not cross through multiple units unless absolutely necessary
 - Multiple leaders from a single label should not be joined at their label ends.

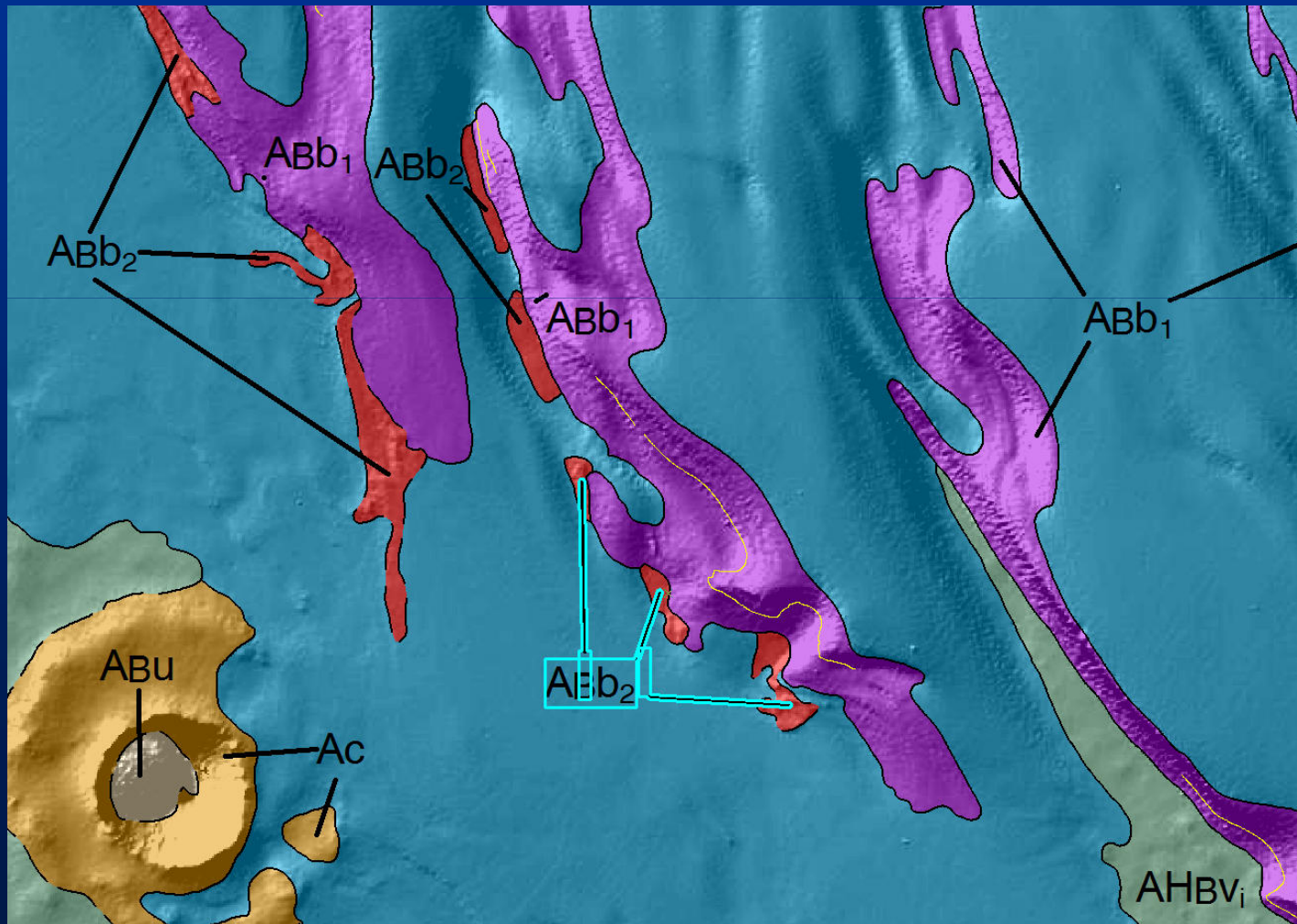
Manipulating Annotation

- Add multiple leaders in locations where the units are too dense or for clear placement of multiple unit symbols



Manipulating Annotation

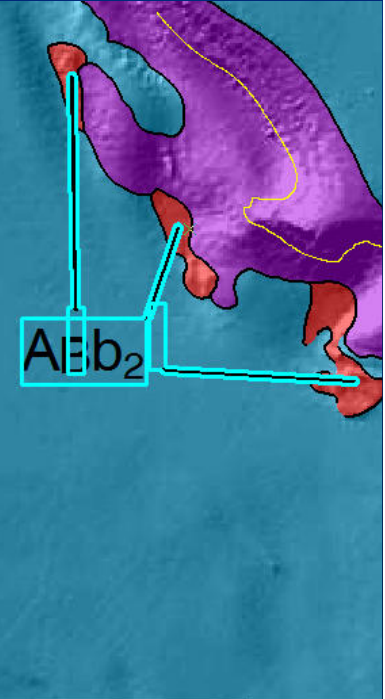
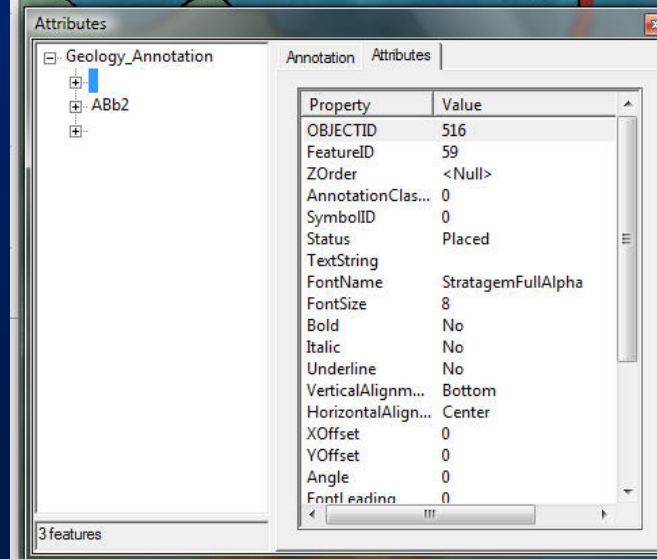
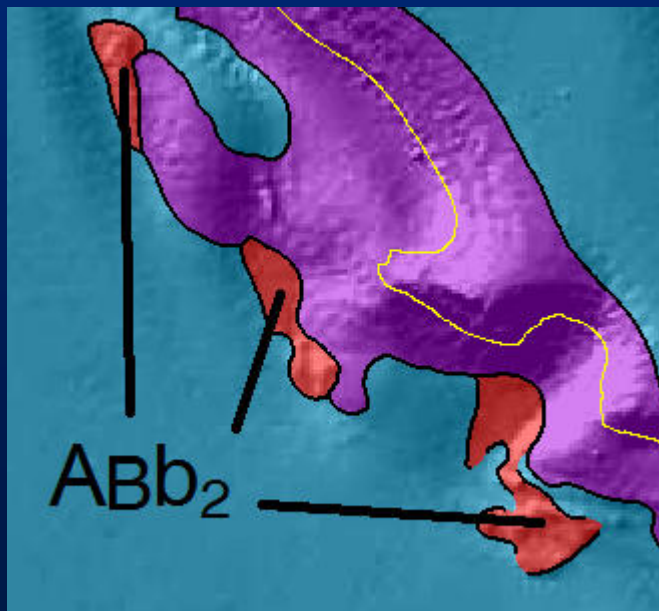
- In ArcGIS, you cannot add more than one leader per label. But there is a work around



Manipulating Annotation

■ Adding Multiple Leaders

- Select and position the one of the labels (this one will include the unit symbol)
- Select another label, right click, choose 'Attributes'
- Click the "Attributes" tab in the 'Attributes' window
- Click on the text string, delete the contents, add a single space
 - Arc does not allow for a blank text string and you will get an error message if you don't include the space
- Move the blank annotation with the leader so that it is pointing from the annotation that displays the unit symbol
- Repeat as necessary



Manipulating Annotation

- Demonstration

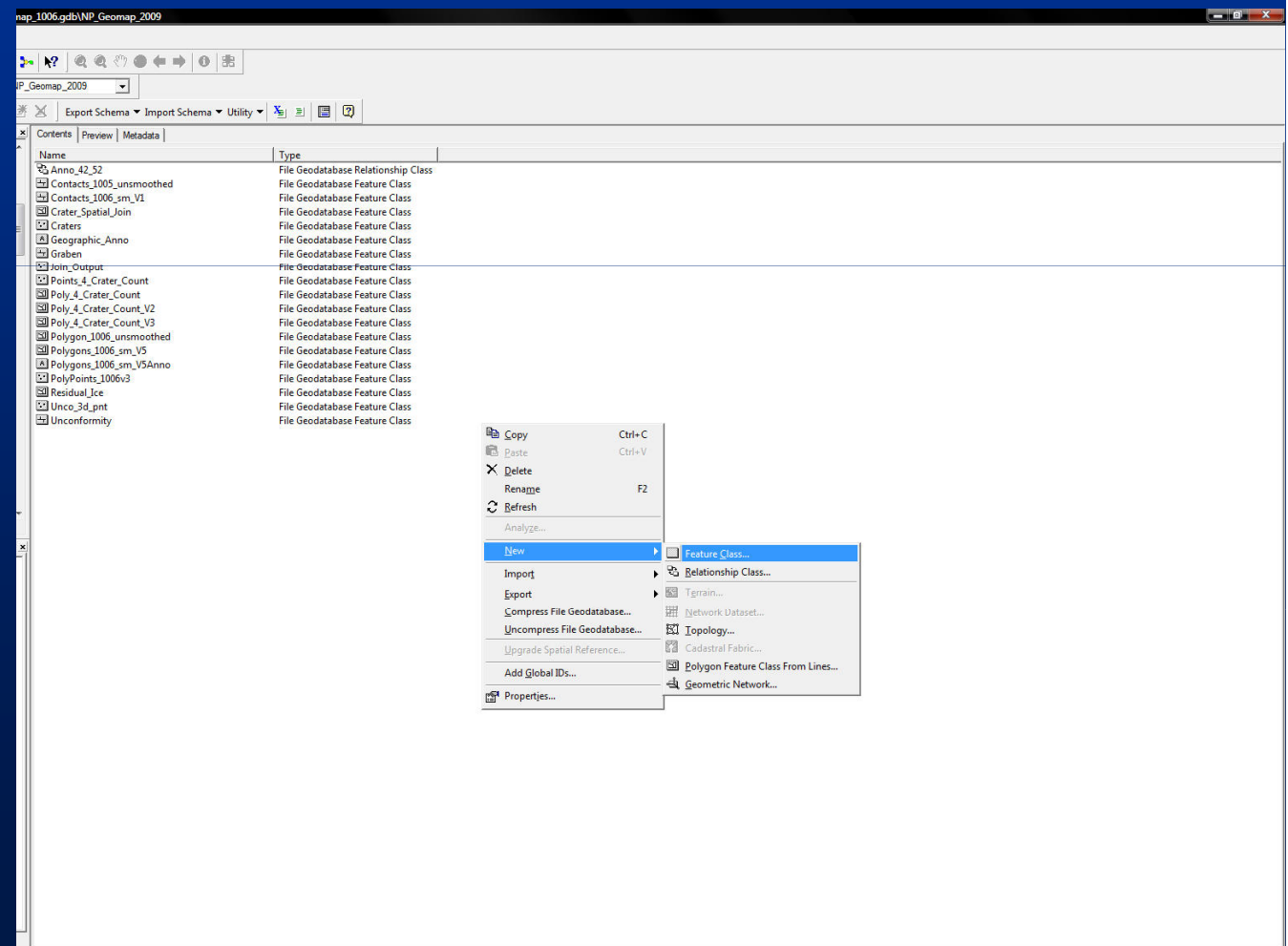
Adding Nomenclature

- Adding the nomenclature to your map area is good for:
 - Review map copies
 - Helping control the final layout of your map
- Because there are no features for the annotation to be tied to, you have to create a new annotation feature class
 - Before you do this, it is helpful to know what nomenclature types are included in your area
 - <http://planetarynames.wr.usgs.gov/>
 - Font styles are different for certain types of nomenclature and are size dependent you may want to set up different symbols for each category
 - This is not required as each anno label can be thoroughly manipulated through the attributes pop-up window
 - We are working on a document that lists standardized fonts and styles based on map scale and feature size

Creating an Annotation Feature Class

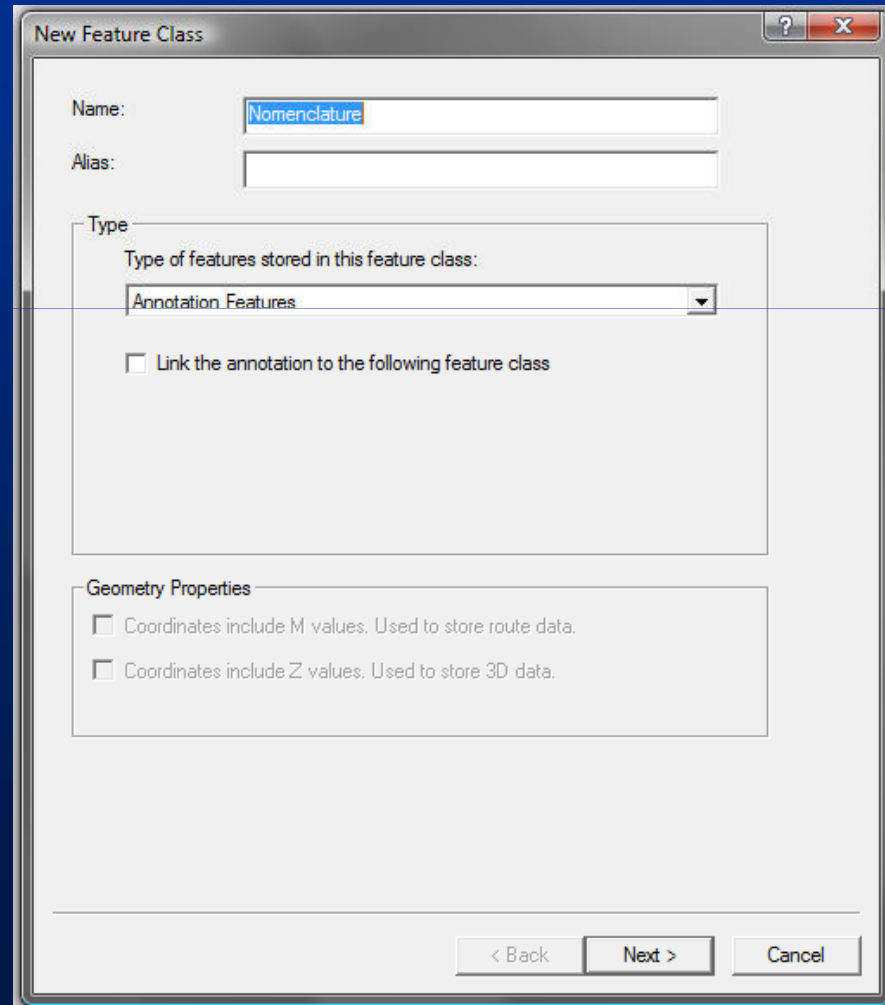
- Open ArcCatalog
- Navigate to the FILE geodatabase where you want to save

Right click
Choose 'New'
and 'Feature Class'



Creating an Annotation Feature Class

- Name the new feature class and select Annotation Features as the type. You do not want to link these to an existing feature class
- Click Next



The screenshot shows the 'New Feature Class' dialog box. The 'Name' field is set to 'Nomenclature'. The 'Type' dropdown menu is set to 'Annotation Features'. The 'Link the annotation to the following feature class' checkbox is unchecked. The 'Geometry Properties' section has two unchecked checkboxes: 'Coordinates include M values. Used to store route data.' and 'Coordinates include Z values. Used to store 3D data.' The 'Next >' button is highlighted.

New Feature Class

Name: Nomenclature

Alias:

Type

Type of features stored in this feature class:

Annotation Features

☐ Link the annotation to the following feature class

Geometry Properties

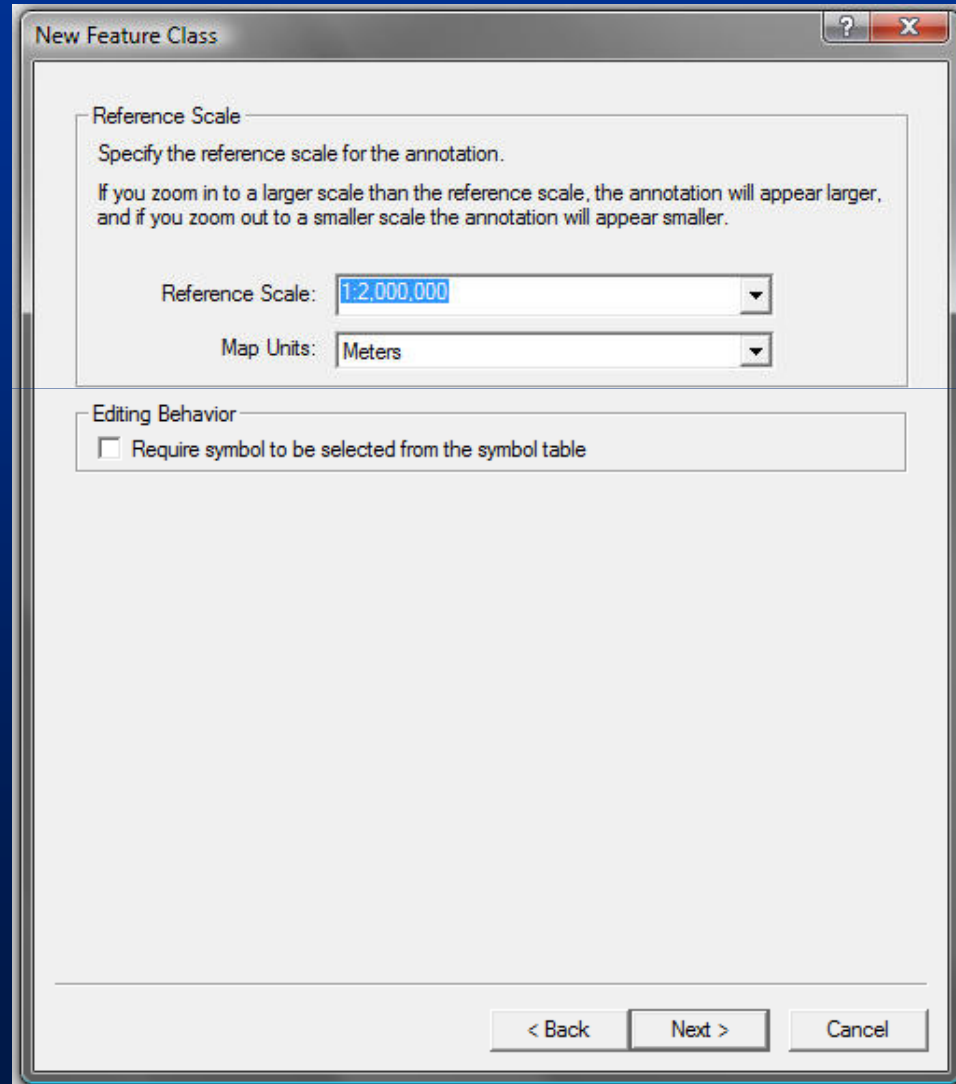
☐ Coordinates include M values. Used to store route data.

☐ Coordinates include Z values. Used to store 3D data.

< Back Next > Cancel

Creating an Annotation Feature Class

- Set the Reference Scale to the same scale as the printed map
- You can ignore the editing behavior check box
- Click Next



The screenshot shows the 'New Feature Class' dialog box. It has a title bar with a question mark and a close button. The dialog is divided into two main sections: 'Reference Scale' and 'Editing Behavior'. The 'Reference Scale' section contains a text box with the value '1:2,000,000' and a dropdown arrow, and a 'Map Units' dropdown menu set to 'Meters'. The 'Editing Behavior' section has a checkbox labeled 'Require symbol to be selected from the symbol table' which is currently unchecked. At the bottom of the dialog are three buttons: '< Back', 'Next >', and 'Cancel'.

New Feature Class

Reference Scale

Specify the reference scale for the annotation.

If you zoom in to a larger scale than the reference scale, the annotation will appear larger, and if you zoom out to a smaller scale the annotation will appear smaller.

Reference Scale: 1:2,000,000

Map Units: Meters

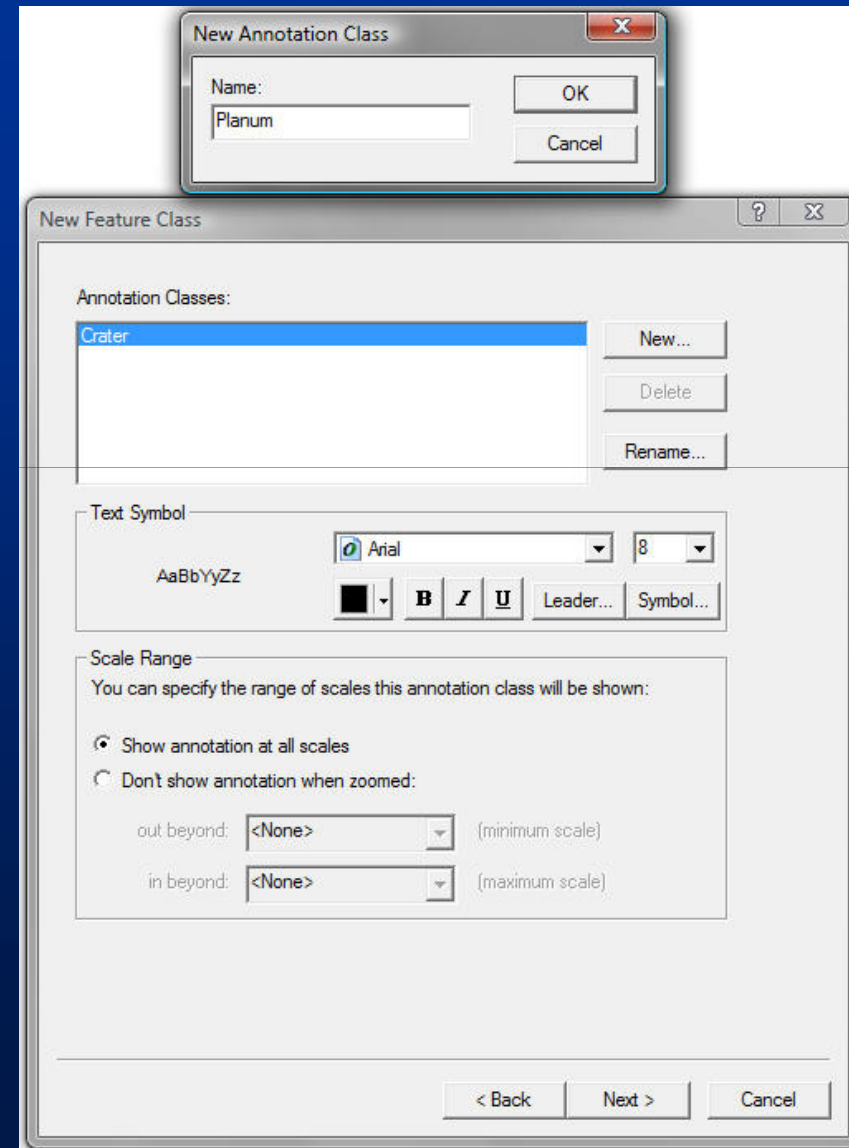
Editing Behavior

☐ Require symbol to be selected from the symbol table

< Back Next > Cancel

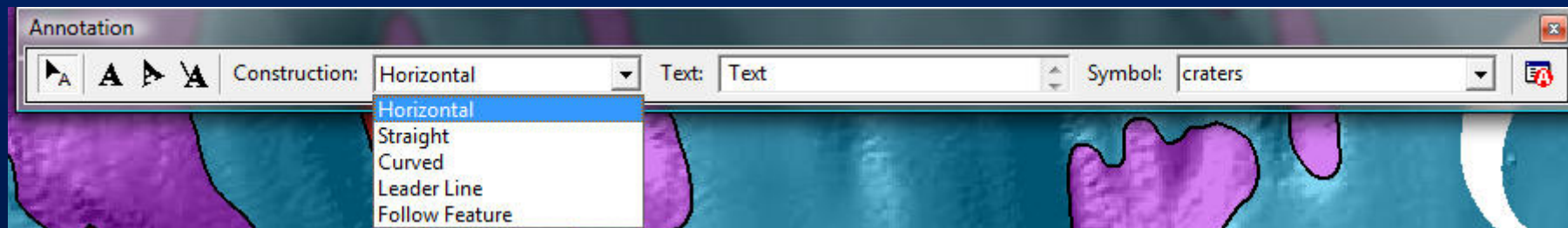
Creating an Annotation Feature Class

- This is where, if you want, you can set up different annotation classes
- Choose “New”, and name the class
- Select the Text Symbol that is appropriate for this class
- When done click next
- If you don’t want to create different annotation classes click Next
- Click Next and then Finish



Adding Annotation

- Add the new annotation feature class to your project in ArcMap
- Start Editing and add annotation using:
 - Horizontal – Top is always up
 - Straight – Not horizontal, at an angle
 - Curved – Curved text
 - Follow Feature – Not as useful as it sounds
- All of these are drawn using the Annotation toolbar tool set and the Edit menu draw tool (pencil)



Creating an Annotation Feature Class

- Demonstration

Checklist for GIS Map Finalization

Checklist for Map Finalization

- GIS vector features

- Contacts/Linear Features (lines)

- Contacts should be snapped to other contacts
 - Contacts should match polygon edges
 - Lines should be smoothed so they're appearance is not angular
 - Attributes defined in the table and displayed with unique symbology
 - Symbology closely follow the FGDC Cartographic Standards

- Geologic Units (polygons)

- Must not contain sliver polygons
 - Polygons must not overlap
 - Polygons colorized by unit type
 - Must have labels or annotation
 - Table should contain at least the unit symbol and unit name

- Point Features (points)

- Uniquely attributed and symbolized
 - Labeled if necessary
 - Sized so they can be seen at the printable map scale

Checklist for Map Finalization

- GIS Raster Data

- For submission:

- Include the USGS base map
 - Include the MOLA DEM and shaded relief
 - All high-resolution datasets used while mapping should be excluded, down sampled, or included as figures, footprint files, supplemental data

- Submission Package

- Include all pertinent GIS vector files with clear and logical naming conventions (Geology, Contacts, Linear Features, etc.)

- Don't include names like:

- 'geology_polygons_edit_ver_2_12122009_what_is_this'*

- Include USGS base map and MOLA data

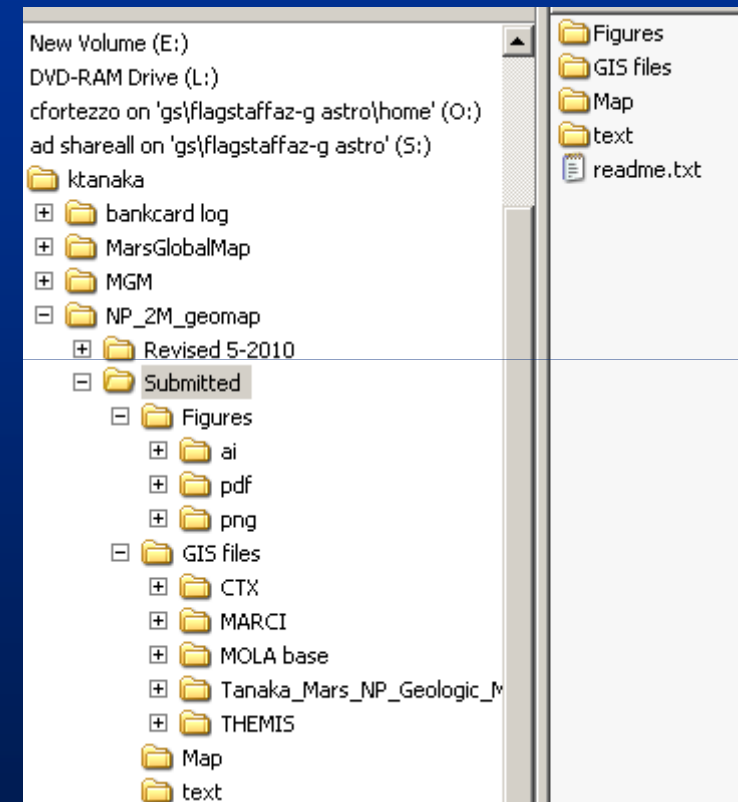
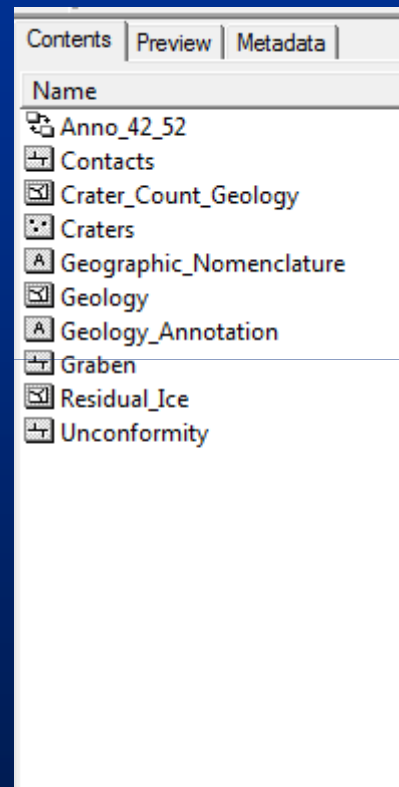
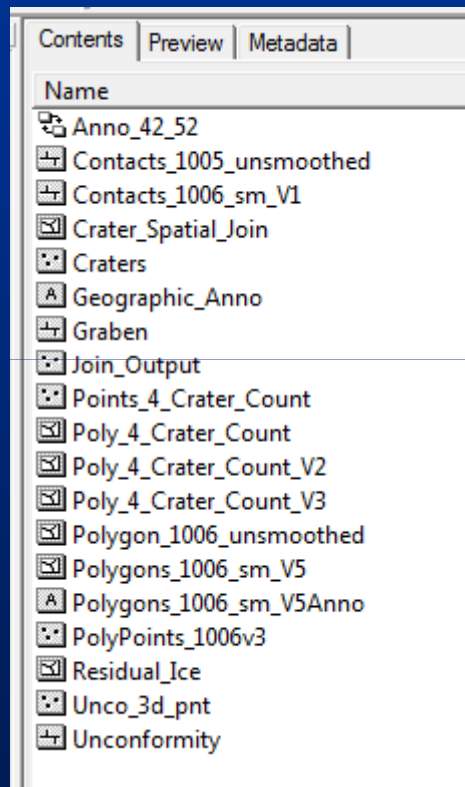
- PDF, exported from Arc at full scale

- METADATA

- Try it, you may like it

Example of Geodatabase and Submission

■ Working Submitted File Structure



New ArcMap 10 features

Top Ten (ESRI)

1. Tables and windows can hide; the user can pin a window open; ...
2. List layers by visibility: zooming into map allows different features to appear and the legend updates accordingly; the SELECT BY LASSO tool will add layer views to the table of contents.
3. Tables: the user can dock tables anywhere on the map view; ...
4. Enhanced reporting ...
5. New search tool box; search results may be from projects or files on your computer or on the web
6. Symbology search: search through 20,000 symbols that are available or use the search box for symbols such as a "fault"
7. Inclusion of catalog window (file browser) into ArcMap
8. Tool Tips for Geoprocessing and ModelBuilder: tool tips have been enabled so the user can see input and output features without accessing the ModelBulder tool individually; Also new is an "undo" or "redo" button; and, the user can include tools and models in the toolbar and dock these tools on the toolbar;
9. Layers can be "time enabled" to isolate a field that has a time stamp so that the user can step though a layer of features by time; a slider bar is used to incrementally step though the time layer
10. License check out is now available so the user does not need to be connected to the server

New ArcMap 10 features

Top Ten (USGS – not all tested)

1. Direct support for PDS and ISIS (Issues: multi-nodata values, odd projections, stability?)
2. Real-time image Analyst add-on (demo), basemaps (cached layers) - maybe ...
3. Easier attribution during editing (demo)
4. Batch geoprocessing editing tools (snap, extend, trim, densify, unsplit line, etc.)
5. New “Mosaic Type” for discrete images, Null data ranges, footprint creation (demo)
6. Faster and better raster processing – maybe...
7. Python scripting built-in
8. Pin-able (auto hide) info, table, tools
9. Annotation additions (contours) and PLTS (production line toolset)
10. No need to be administrator to add-in tools